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DIOTICARPUS DUNN AND BALANOCARPUS BEDD.

P. V. BOLE.

Dioticarpus Dunn is a monotypic genus and *D. barryi* Dunn from South India is the type. Dunn¹, while introducing the new genus says, "a *Balanocarpus* Bedd., sepalis 2 in alas breves auriformes auctis differt."

The presence of the same two winged sepals distinguishes *Hopea* Roxb. from *Balanocarpus* Bedd. As a matter of fact the three allied genera *Hopea* Roxb., *Dioticarpus* Dunn, and *Balanocarpus* Bedd., according to the original descriptions, can only be distinguished by their fruits as the inflorescence in every case is strikingly similar.

Dioticarpus Dunn is known only from the original collections, and of these the material is so scanty that it is difficult to form a definite opinion as to the status of Dunn's new genus. The writer of this note has examined the only two sheets of *D. barryi* Dunn in India (Madras Herbarium, Coimbatore, no. 3464) and has come to the conclusion that both sheets belong to *Hopea* Roxb. The type sheet of *D. barryi* Dunn is in Herb. Kew. At this writer's request Dr. D. Chatterjee, at the time Assistant for India at Kew, examined it and agreed with his conclusions, and further stated that the Kew sheets had all been labelled as 'Hopea' by Dr. Hutchinson. It is worth noting that the type sheets in Kew Herb. possess neither the fruit nor a drawing thereof. The structure of the fruit which possesses two winged sepals strongly suggests the reduction of *Dioticarpus* Dunn to *Hopea* Roxb.

The systematic position of the genus *Balanocarpus* Bedd. has been studied by the Malayan Forest Botanists particularly by Symington^{2,3}. As a result of their work all the species of this 'anomalous' genus, except *B. heimii* King, seem to have been transferred either to *Hopea* Roxb. or to *Shorea* Roxb. (Foxworthy⁴). The careful anatomical studies by Desch⁵ have shown that the wood of *B. heimii* King is very closely related to that of several spp. of *Hopea* Roxb. though it can be distinguished from them.

In view of all these changes, the position of the two Indian species of *Balanocarpus* Bedd. (*B. erosa* & *utilis* Bedd.) demands careful consideration. *B. erosa* Bedd., the type of the genus, seems to be very closely allied to the only Malayan species *B. heimii* King; in consequence, any attempt at shifting one species to another genus must also include the other species. Foxworthy⁴ in his account of the distribution of Dipterocarps, is inclined

to consider *B. erosa* Bedd. as a species of *Hopea* Roxb. The author of the present note very reluctantly has to disagree from such a view until further anatomical and morphological evidence be brought forward. The fruit morphology of these two species of *Balanocarpus* (i.e. *B. erosa* Bedd. & *B. heimii* King) is so different from that of *Hopea* Roxb. that their retention in a separate genus seems to be justified.

As for the second Indian species *B. utilis* Bedd., Dyer⁶ considered his *Hopea longifolia* Dyer to be a synonym of *B. utilis* Bedd. and Gamble⁷ accepted the reduction. Moreover, an examination of the original collection very strongly suggests that *Dioticarpus barryi* Dunn is conspecific with the former plant ; in the flowering stage they cannot be distinguished one from the other ; in his original description Dunn mentions that the fruit of *D. barryi* Dunn has two wings, Beddome⁸, on the other hand did not mention the wings in *B. utilis* Bedd. But from a study of the type sheets one gets a very strong impression that both winged and wingless fruits may be developed in both cases on the same tree ; this is a point that needs further elucidation from field-workers.

To conclude, it is this author's considered opinion that the two names *Dioticarpus barryi* Dunn and *Balanocarpus utilis* Bedd. are synonymous and that therefore both should be fused under one name and in this case Beddome's name has priority over that of Dunn. Moreover, the author considers *Balanocarpus utilis* Bedd. to be a species of *Hopea* Roxb. for which again Beddome's specific name is one year older than that of Dyer. The following changes in nomenclature are proposed here :

Hopea Roxb., Hort. Beng. 42, 1814 ; Pl. Corom. 3 : 7, 1819.

Syn. : *Dioticarpus* Dunn, Kew Bull. 337, 1920.

Hopea utilis (Bedd.) Bole comb. nov.

Balanocarpus utilis Bedd., For. Man. Bot. 236, 1873 ; Dyer, in Trim. Journ. Bot. 3 : 154, 1874 ; Gamble, Fl. Mad. 84, 1915.

Hopea longifolia Dyer, in F.B.I. 1 : 309, 1874.

Dioticarpus barryi Dunn, Kew Bull. 337, 1920.

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3. ———— *Gard. Bull. Straits Settle.* 9 : 325–330, 1938.
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7. Gamble, J. S.—*Flora of Madras*, 84, 1915.
8. Beddome, R. H.—*For. Man. Bot.* 236, 1873.

The author wishes to record his thanks to Dr. K. Biswas, Superintendent Royal Botanic Gardens, Calcutta, for suggesting the study ; Mr. F. W. Foxworthy of Berkeley, California (U.S.A.), Dr. D. Chatterjee, Systematic Botanist, Agricultural Research Inst., New Delhi and Rev. H. Santapau S.J. of St. Xavier's College, Bombay for help and advice in preparing this note.

A NEW SPECIES OF *RANUNCULUS* FROM EAST AFRICA

E. MILNE-REDHEAD AND W. B. TURRILL

In preparing the account of *Ranunculaceae* for the "Flora of Tropical East Africa" we came across an unnamed gathering of *Ranunculus* in the British Museum Herbarium that had been collected in 1935 by Dr. G. Taylor. This species, which was from over 4,000 m. on the Kenya side of Mt. Elgon, did not agree with any species we had seen, but appeared to have affinities with *R. aberdaricus* Ulbr. which is endemic in the Aberdare Range where it is found at about 3000 m.

Through the kindness of Mr. Olov Hedberg we have been privileged to see the *Ranunculaceae* from the fine collection of high mountain plants collected by him in East Africa in 1948. Among these was a further gathering of this species, this time from a similar altitude on the Uganda side of the mountain.

An excellent photograph of the plant growing *in situ* shows it to be densely leafy with the flowers rather inconspicuous and largely hidden by the leaves. This may well account for the species having been overlooked by earlier collectors who had visited the alpine zone of Mt. Elgon. A description of this new species follows this note. We have made Hedberg's no. 1005 the type since we were able to dissect his material.

Ranunculus cryptanthus Milne-Redhead et Turrill, sp. nov.; a *R. aberdaricus* Ulbrich foliis trisectis segmentis cuneatis saepissime late cuneatis differt.

Herba perennis, humilis, 5–10 cm. alta. *Rhizoma* 3–4 cm. longum, 4–8 mm. in diametro, radicibus numerosis elongatis instructum. *Caules* saepe brevissimi usque ad 8 cm. longi, glabri vel fere glabri; internodis 2–15 mm. longis. *Folia* numerosa; lamina trisecta, ambitu fere rotundata vel oblata, 1.5–2.3 cm. longa, 2.4–3.8 cm. lata, nervis in pagina adaxiale leviter sulcatis in pagina abaxiale vix conspicuis, utrinque pilosis pilis albis plus minusve adpressis in foliis junioribus sericeis instructa, segmentis subacutis vel obtusis basi cuneatis saepe late cuneatis, segmento terminale 1.3–2.1 cm. longo 1.2–2.2 cm. lato saepe trilobo lobis grosse tridentatis, segmentis lateralibus obscure oblique trilobatis lobis grosse dentatis; petiolum 2.5–5.8 cm. longum, valde vaginatum, patule pilosum. *Inflorescentia* 1–3-flora, pedicellis arcuatis brevibus. *Sepala* patula, elliptico-oblonga, subacuta, 5 mm. longa, 2 mm. lata, trinervia, in pagina abaxillare valde sericeo-pubescentia. *Petala* spatulato-oblonga vel elliptico-oblonga, apice rotundata, 4–4.5 mm. longa, circiter 1.5 mm. lata, flava. *Stamina* haud numerosa, filamentis 2.0 mm. longis, antheris 0.5 mm. longis. *Carpella* valde oblique asymmetrica, stylo breviter hamato. *Achenia* ambitu plus minusve elliptica late obovata apice abrupte acuta, 2 mm. longa, 1.5 mm. lata, laevia, haud marginata.

UGANDA: Mbale District, Mt. Elgon, in the crater, N.E. of the Uganda pass, on disturbed ground in the alpine belt, 4100 m., 19.5.1948, flowers yellow. O. Hedberg 1005 (holotypus, in Herb. Upsal.).

KENYA: Trans Nzoia District, Mt. Elgon, in damp places, in rock shelter, 4050 m., 22.2.1935, creeping herb, petals golden yellow. G. Taylor 3542 (in Herb. Brit. Mus.).

A NOTE ON LAMARCK'S ENCYCLOPEDIE.

B. L. BURTT.

The dates of publication of Lamarck's works are a notorious problem in the bibliography of systematic botany, and it therefore seems advisable to put on record each crumb of evidence that comes to light.

In his recent notes on this subject Rothmaler (in *Chronica Botanica*, 5 : 438. 1939) gives the date of the second part of volume 3 (p. 369 onwards) of Lamarck's *Encyclopédie Méthodique, Botanique*, as 1791-1792. This leaves it uncertain whether Lamarck's work came out before or after another important book which was published in 1791, that is Volume 2 of J. Gaertner's *De Fructibus et Seminibus Plantarum*.

This problem is resolved by finding that on p. 633 of Lamarck's *Encyclopédie Desrousseaux*, the author of the article on 'Luserne' (*Medicago*), cites "*Medicago orbiculata*. Gaertn. de fruct. vol. 2. pag. 349. Tab. 155" under *M. orbicularis*. On the same page he also cites Gaertner under *M. scutellata* and again on page 637 under *M. intertexta*, while finally on p. 638 *M. hispida* Gaertn. is mentioned under *M. lappacea*. It is therefore clear that volume 2 of Gaertner's work antedates the second part of volume 3 of Lamarck's *Encyclopédie*.

It may perhaps be mentioned that the first part of volume 3 of the *Encyclopédie* (1789) evidently appeared after volume 1 of Gaertner's *De Fructibus et Seminibus* (also 1789) as there is a reference to it in Lamarck's *Avis de l'auteur* (p. viii).

THE IDENTITY OF POLYGALA PHYLICOIDES THUNB.

Whilst studying the specimens of *Muraltia* (*Polygalaceae*) from Thunberg's Herbarium, which had been kindly loaned to Kew by the Director of the Botanical Museum, Uppsala, Dr. M. R. Levyns discovered that the type specimen of *Polygala phyllicoides* was not a *Muraltia* as had been supposed by De Candolle and by other earlier workers, and that it was a species of *Amphithalea* (*Leguminosae*). Comparison with material of *Amphithalea* shows that the Thunberg specimen agrees extremely well with *A. villosa* Schltr. var. *brevifolia* Schltr. Happily this discovery does not necessitate a change of name in *Amphithalea*, for the epithet "*phyllicoides*" had already been used by Ecklon & Zeyher in that genus for a different species. The synonymy of *Amphithalea villosa* var. *brevifolia* is, however, as follows :—

***Amphithalea villosa* Schltr. var. *brevifolia* Schltr.** in Engl., Bot. Jahrb. 27, 142 (1899).

Polygala phyllicoides Thunb., Prodr. Pl. Cap. 121 (1800), *synon. nov.*, non *Amphithalea phyllicoides* Eckl. & Zeyh., Enum. Pl. Afr. Austr. 170 (1836)
Muraltia phyllicoides (Thunb.) DC., Prodr. 1, 337 (1824) ; Harv. & Sond., Fl. Cap. 1, 105 (1859), *quoad nom. et synonym.* Thunb.

E. MILNE-REDHEAD.

A NEW SPECIES OF DIGITALIS FROM GREECE—DIGITALIS MACEDONICA.

V. H. HEYWOOD.

While working through the genus *Digitalis* L. in the Edinburgh Herbarium a sheet of un-named specimens collected by E. K. Balls and W. Balfour Gourlay in Macedonia, Greece, was examined and found to bear two species—*D. viridiflora* Lindley and a single plant of another species which could not be assigned to any known form. The same species was found in the Kew Herbarium, separately and under another number, and the field-note of Balls for this number agreed with the specimen. Apparently the Edinburgh specimen had been mixed with a collection of *D. viridiflora* under another label and its own label lost. It is described here as a new species.

Digitalis (Sect. *Tubiflorae* Benth.) **macedonica** Heywood, **sp. nov.** ; affinis *D. luteae* L. sensu amplo sed ab omnibus eius subspeciebus et varietatibus distincta colore fusco-brunneo (haud luteo, luteo rubro-fusco suffuso, ochroleuco vel albo-luteo) atque venis corollae valde et manifeste coloratis ; a subsp. *linnaei* Litardière, *micrantha* Litardière, *cedretorum* Emberger et *transiens* (Maire) Emberger & Maire sepalis duas partes tubi corollini adtingentibus inter alia recedit ; eadem caractere cum subsp. *atlantica* (Ball) Litardière congruit sed corollis duplo majoribus aliter lobatis, inflorescentia pauciflora laxa (haud apice comosa) longius distat. Etiam affinis *D. laevigatae* Waldst. & Kit. sed laciniis calycis angustioribus, non parum membranaceis, corolla minore vix ventricosa lobis acutis distincta.

Ob affinitates supra dictas species haec connectionem inter Sectionem *Tubifloras* Benth. et *Globifloras* Benth. monstrare videtur.

Herba glabra, ut videtur, perennis. *Caulis* erectus, ad 66 cm. altus, 3 mm. latus, foliatus. *Folia* supra viridia, subtus pallidiora, in utraque pagina glaberrima, margine minute serrata ; *folia basilaria* ignota ; *inferiora* oblanceolata, in petiolum sensim attenuata, longe decurrentia ; *reliqua* oblongo-lanceolata vel lanceolata, semi-amplexicaulia, superne diminuta, sensim in bracteas transformata. *Racemus* laxiflorus, elongatus, rachide parce glandulosa. *Pedicelli* breves, nutantes, sparse glandulosi, apice incrassati. *Bracteae* lanceolatae, acutae, flores aequantes, glabrae, margine stipitato-glandulosae. *Calycis* segmenta inaequalia, lanceolata vel oblongo-lanceolata, acuta, 1 cm. longa, duas partes tubi corollini aequantia, margine glanduloso-ciliata. *Corolla* tubulosa, parva, circa 2 cm. longa, fusca (pallide aurantiaco-brunnea in sicco), externe dense glandulosa, valde colorato-reticulato-venosa ; labium superius lobulis binis acutis 1 mm. longis ; labium inferius lobis lateralibus anguste triangularibus acutis 2 mm. longis, lacinia intermedia oblongo-ovata acuta glabra 6 mm. longa lateralibus triplo latiore. *Stamina* inclusa ; *antherae* 1.5 mm. longae, loculis divergentibus, apice confluentibus. *Stylus* glaber, ovario fere duplo longior. *Ovarium* glandulosum, ovatum, 4–5 mm. longum. *Capsula* ignota.

GREECE. Macedonia : Djon, Mt. Smolika to Samarina, 4 July 1937, E. K. Balls & W. Balfour Gourlay B. 3529 (Typus in Herb. Kew.) ; *id.* pro errat. cum *D. viridiflora* (e loco Skutina, nr. Samarina, coll. E. K. Balls & W. Balfour Gourlay 3527) in Herb. Edin. mixtum (Isotypus).

Field-note : Flowers dark brown, small, sparsely spaced on slender stems to 2 ft. tall. Leaves dark green glabrous, glossy. Open Pine-woods, non-lime formation.

The Edinburgh specimen, as has been explained above, has been mixed with *D. viridiflora* under another number corresponding to another locality but it is clearly of the same gathering as the type and should be called an isotype and not a paratype.

The affinities of the new species appear at first sight to be restricted to the other members of the Sect. *Tubiflorae*. *D. macedonica* however shows certain resemblances to *D. laevigata* (Sect. *Globiflorae* Benth.). There is little in vegetative characters to separate these two species and the flowers of *D. macedonica* agree much more with *D. laevigata* in colouring than with the other members of the Sect. *Tubiflorae* (except perhaps *D. parviflora* Jacq.) ; the corolla of *D. macedonica* is slightly ventricose suggesting a connection with the Section *Globiflorae* whose species differ from those of the Sect. *Tubiflorae* in having an inflated subglobose or ventricose corolla (not tubular scarcely ventricose). However the size of the corolla, its only slight development towards being ventricose, and the shape of its lips immediately distinguishes *D. macedonica* and (as it is at present known) places it well within the Sect. *Tubiflorae*.

Among the *Tubiflorae* there is no doubt of its close relationship to the *D. lutea* complex. Even excluding minor variations, *D. lutea* is very complicated taxonomically due to its great development in North Africa where it is represented by subsp. *atlantica* (Ball) Litardière (= *D. lutea* var. *atlantica* Ball = *D. ballii* Lindberg = *D. subalpina* Braun-Blanquet), subsp. *transiens* (Maire) Emberger & Maire (= *D. transiens* Maire), and subsp. *cedretorum* Emberger (= *D. cedretorum* (Emberger) Maire).

Maire (1940) says of these forms “. . . paraissent au premier abord bien distinctes entre elles et du *D. lutea* L. ; la plus éloignée de ce dernier est le *D. subalpina*. Mais les transitions établies par le *D. transiens* et le *D. cedretorum* sont telles qu'on peut les considérer comme des sous-espèces de l'espèce collective *D. lutea* L.” Later (v. Emberger & Maire : 1941) he does in fact employ this suggested classification.

If these are then accepted as subspecies of *D. lutea*, as seems the best treatment, it becomes naturally more difficult to separate *D. macedonica* from the resultant complex *D. lutea* due to the many agreements and disagreements in individual characters with the separate North African components. If *D. lutea* is taken in its widest sense, so as to include the diploid subsp. *micrantha**, *D. macedonica* is separated from all the segregates by only a few characters such as the dark brown colour of the flowers, the very pronounced coloured venation of the corolla and the shape of its lobes, and the few-flowered raceme ; the length of the sepals— $\frac{2}{3}$ as long as the corolla—also distinguishes it from most forms ; but reference should be made to the accompanying table for details of the divergences of *D. macedonica* from each separate unit of *D. lutea* sensu lato.

Although the number of comprehensive differential characters of *D. macedonica* from *D. lutea* is small this does not detract from its specific

*The typical subspecies *limnaii* Litardière is tetraploid.

status. *D. macedonica* is further removed from the whole of the *D. lutea* complex than any of the latter's components from each other.

D. lutea has been recorded only doubtfully from Greece (Sibthorp—Arcadia), and Halaácsy (1902) states that it has not been collected recently. Hayek (1929) also doubts its occurrence in Greece. Dr. E. F. Warburg has kindly examined for me the *Digitalis* specimens in the Sibthorp Herbarium at Oxford and he informs me that there is no specimen labelled *D. lutea* by Sibthorp. There is however a sheet labelled (by Druce apparently) "*D. viridiflora*—*D. lutea*? Prod. 1 439" and Dr. Warburg thinks that it is correct to assume that this is Sibthorp's *D. lutea*. As the determination as *D. viridiflora* is accurate it appears that the Arcadian record of *D. lutea* may be discounted. It is interesting to note the occurrence of the closely related *D. macedonica* in Greece—well without the range of *D. lutea*.

Two other species of this section have been recorded from Macedonia ; one of them, *D. charrelii* Heldr. (apud Charrel : 1892) was published as a *nomen nudum* with a note "aspectus *D. viridiflorae*, sed flos *D. luteae*". The editor allowed this *nomen nudum* to be published because he thought that the statement of the author was valuable and hoped that the description would be published shortly. *D. charrelii* was discovered on Tchairli-dagh (Chairli dag) which is 75 miles south east of Samarina.

In 1889, three years earlier, in a paper on the Oriental species of *Digitalis* by Nadji (alias Charrel) a new species was given—*D. nadji* Heldr. (Sect. *Tubiflorae* Benth.)—also from Tchairli (Tsairli). It has not been possible to see this paper but in 1892, the year of publication of *D. charrelii*, Nadji gave a brief description of *D. nadji* Heldr. et Nadji from which it is clear that the species has "the appearance of *D. viridiflora* but the flowers of *D. lutea*". Since it is highly improbable that two new species of the Sect. *Tubiflorae* so closely related (*e descript.*) would be found on the same mountain it is justifiable to conclude that *D. nadji* is synonymous with *D. charrelii*. It would appear that Charrel had the species named after himself twice—under both his names !

No specimens of *D. nadji* have been traced and its specific status is uncertain but if it proves to be in fact distinct it would point to a connection in floral structure linking *D. viridiflora* with *D. lutea* and *D. macedonica*.

I wish to thank Mr. B. L. Burtt for his kindness in reading the manuscript and for many helpful suggestions ; also the Royal Geographical Society and the Royal Scottish Geographical Society for assistance in tracing Macedonian localities.

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Plants and Animals in Hong Kong*. One usually thinks of Hong Kong as one of the great business centres of the Far East. As a port and an exchange market and, nowadays, as one of the few links between China and the West it is well known to the general public. Probably only a minority of even professional biologists are aware that Hong Kong, the island and the mainland Territories, has a most interesting flora and fauna. Dr. G. A. C. Herklots was for some twenty years Reader in Biology in the University of Hong Kong. The book* he has written is full of first hand information regarding the plants, mammals, birds, reptiles, and invertebrates of Hong Kong. It is by no means a textbook though from its pages there could be compiled an adequate summary of many of the important facts concerning the plants and animals of the colony.

Dr. Herklots first describes the organisms of the countryside month by month from January to December. His account is enlivened by anecdotes and personal reminiscences. There is much valuable information regarding the plant life, especially that of an ecological nature. An account of special plant groups is given under the heads of oaks, figs and banyans, palms, wild spices, edible wild fruits, gall nuts, poisonous plants, parasites, mistletoe, insectivorous plants, and water ferns. There is a useful list, with biographical information, of early European botanists in South China and in Hong Kong. An outline of walks and climbs is given in half-a-dozen pages.

The book is excellently illustrated by both coloured and black and white plates and also by many text figures. Most of the illustrations are the work of the author himself. The majority are serious and accurate, a few are whimsically amusing and add to the lively atmosphere of a charming book. There is an index but it is unfortunate that no map is provided.

W. B. TURRILL.

*The Hong Kong Countryside, G. A. C. Herklots, The South China Morning Post, Ltd. 1951.

Essential Oils*. Schimmel's well known "annual reports on essential oils" have now been issued for over half a century and during this period have contributed much to our knowledge of this important group of economic plant products. The present number, published in New York, maintains the high standard set by its predecessors and contains up-to-date information on a wide range of volatile oils and on aromatic chemicals and related materials. Apart from the general treatment of individual essential oils there are short articles on such subjects as:—Sources of Essential Oils, Biogenesis of Essential Oils, Methods of Analysis, Antibiotic Activity of Essential Oils and Odor Perception. A number of good photographs are included, also a bibliography and index.

F. N. HOWES.

*Annual Report on Essential Oils, Aromatic Chemicals, and Related Materials 1947-48. Schimmel & Co., Inc., 601 West 26th Street, New York, 1, N.Y. Pp. 125.

NAMES	LEAVE	RACEME	PEDICELS	BRACTS
DIGITALIS MACEDONICA	Oblong-lanceolate or lanceolate. Margin minutely serrated. Glabrous	<i>Rachis</i> slightly glandular. <i>Inflor.</i> loose-flowered.	Sparsely glandular.	= flowers. — Glabrous. Margin stipitate-glandular.
DIGITALIS LUTEA Subsp. ATLANTICA (=D. SUBALPINA)	Linear lanceolate. Margin entire or subdentate. Glabrous.	<i>Rachis</i> glabrous. <i>Inflor.</i> dense ∞ -flowered, comose at the apex.	Glabrous.	> flowers. Glabrous ; margin ciliate glandular.
DIGITALIS LUTEA Subsp. CEDRETORUM (=D. CEDRETORUM)	Lanceolate. Margin dentate. Upper with margin slightly ciliate ; lower glabrous.	<i>Rachis</i> shortly glandular-pilose. <i>Inflor.</i> laxer fewer flowered than preceding.	Densely glandular-pilose.	= flowers. Margin densely and longly ciliate shortly glandular-pilose even on the
DIGITALIS LUTEA Subsp. TRANSIENS and β <i>mesatlantica</i> . (=D. TRANSIENS)	Lanceolate or linear-lanceolate. Margin dentate. Glabrous.	<i>Rachis</i> glabrous. <i>Inflor.</i> dense ∞ -flowered, scarcely comose. β <i>Inflor.</i> laxer conspicuously comose.	Glabrous.	< flowers. Glabrous, margin ciliate with long articulate and short glandular hairs mixed. β Margin ciliate sl. glandular-pilose.
DIGITALIS LUTEA Subsp. LINNAEI	Oblong-lanceolate. Margin sl. serrate-dentate. Glabrous or slightly pubescent especially at the margins	<i>Rachis</i> slightly glandular. <i>Inflor.</i> rather dense, many-flowered.	Sparsely glandular or gland-pilose, occ. glabrous.	< flowers typically. Sparsely gland-papillose on the surfaces. Margin shortly glandular longly ciliate.

of *D. macedonica* with *D. lutea sensu lato*.

SEPAL	COROLLA		COROLLA	
	COLOUR & DIMENSIONS	UPPER LOBES	LATERAL LOBES	LOWER LOBES
Lanceolate or oblong-lanceolate. Glabrous. Margin glandular-ciliate = $\frac{2}{3}$ corolla.	Dark-brown, markedly reticulate with coloured veins. Densely glandular outside. 2 cm. long.	Acute. 1 mm. long.	Narrowly triangular acute. 2 mm. long.	Oblong ovate acute. 6 mm. long.
Margins and inner surfaces glabrous.				
Lanceolate-linear. Glabrous. Margin glandular-ciliate. > $\frac{1}{2}$ corolla.	Yellowish-white. Glabrous or minutely glandular outside. 1 cm. long.	Obtusish 2.5 mm. long.	Acute. 2 mm. long.	Ovate-obtuse rounded. 3-4 mm. long.
Glabrous or bearing a few glandular hairs outside, margins bearing long articulate hairs mixed with short glandular hairs ; inner faces densely villose.				
Ovate-lanceolate. Densely and shortly glandular-pilose. Margin longly ciliate and shortly glandular-pilose. < $\frac{1}{2}$ corolla.	Yellow suffused with red-brown coloration (esp. lower lip). Laxly and shortly glandular-pilose outside. 2 cm. long.	Shortly acuminate-acute at apex. 4 mm. long.	Triangular acute. 4 mm. long.	Rounded at apex. 6-7 mm. long.
Margins longly ciliate and very shortly glandular pilose ; longly villose on inner faces.				
Linear-lanceolate (slightly broader than <i>D. subalpina</i>). Glabrous. Margin ciliate with long articulate and short glandular hairs. \pm = corolla.	Pale ochre-yellow. Glabrous. 15-17 mm. long.	Obtusish. 4.5 mm. long.	Broadly ovate-obtuse. 4 mm. long.	Rounded. 5 mm. long.
Margins with articulate eglandular hairs ; longly ciliate ; densely and longly villose on inner faces.				
		β Obtusish 5 mm. long.	Ovate-obtusish. 4.5 mm. long.	Rounded. 5 mm. long.
Lanceolate. Glabrous. Margin stipitate glandular. < $\frac{1}{2}$ corolla.	Clear yellow. Minutely glandular, or glandular-pilose, outside. 1.5-2.5 cm. long.	Acute. 3 mm. long.	Triangular acute. 2-3 mm. long.	Ovate or elliptical-acute. 5-6 mm. long.
Margins ciliate-glandular, occasionally mixed with a few eglandular hairs ; inner faces densely villose.				

SPECIES OF MARASMIUS DESCRIBED BY BERKELEY FROM TROPICAL AMERICA.

R. W. G. DENNIS.

Either alone or in collaboration with Montagne, Curtis or Cooke, Berkeley described a very large number of species of *Marasmius* from the West Indies and Brazil. They are easily separable into two groups, namely, those with the pileus surface covered with pyriform cells bearing short slender processes, the cystides-en-brosse of French authors, and those in which the pileus surface is formed of parallel or woven hyphae. The former, referable to *Marasmius* Fr. sensu stricto, i.e. as typified by *Agaricus rotula* Scop. ex Fr. = *Androsaceus* Pat., are discussed below. His remaining species in this group, as reinterpreted in the light of recent collections from Trinidad, have been described and figured in a forthcoming paper in the British Mycological Society's Transactions. These are *Marasmius aciculaeformis* Berk. & Curt., *M. haedinus* Berk., *M. helvolus* Berk., *M. ferrugineus* Berk., *M. leoninus* Berk., *M. pruinatus* Berk. & Curt., *M. rhabarbarinus* Berk. and *M. tageticolor* Berk. For easy reference I have added to the present paper notes on *M. dispar* (Mont.) Fr. and *M. fulvus* Mont., also figures of a few other species proposed by Montagne or Spegazzini which appear possible synonyms of some of Berkeley's fungi.

***Marasmius atrorubens* (Berk.) Berk.** in Hooker's Journal of Botany **8**, 137 (1856). *Agaricus atrorubens* Berk. in London Journal of Botany **1**, 138 (1842).

Pileus 1 cm. diameter, chestnut (Ridgeway), expanded, gills rather crowded, regularly inserted of two lengths, adnate to the apex of the stipe without a collar, edge coloured like the pileus; stipe paler than the pileus, clothed throughout with stiff, erect, pointed, yellowish hairs up to $80 \times 6-8\mu$; pilocystidia and cheilocystidia alike $6-7\mu$ wide with reddish-brown processes, no pleurocystidia, spores not recovered.

Type: Surinam, *Hostmann* 297. Fig. 1.

This is identical in appearance with the type of *M. jamaicensis* Murr. which has the coloured gill edge while the types of *M. portoricensis* Murr. and *M. castaneus* Mont. differ only in their less coloured cheilocystidia and may well represent the same species. After the diagnosis of *M. castaneus* Montagne added: "Cette espèce ne ressemble à aucun Marasme décrit. M. Berkeley m'écrit que ce n'est point son *M. atrorubens* qu'on verra indiqué plus loin." The reference here is to Leprieur 1021 which will be discussed below. Berkeley's opinion expressed to Montagne was apparently due to his conception of *M. atrorubens* having changed with time for of five other collections so named by him and now attached to the type sheet at Kew none agrees with the type. Four of them, Spruce 101, ad folia, and 106, in ramulis, Panuré, Brazil and Wright 102 & 146 from Cuba all have smooth stipes and seem allied to *M. floriceps* Berk. The fifth is an example of Leprieur No. 1021 from French Guiana which had been sent by Montagne to Berkeley under the manuscript name *M. korthalsii* Fr. var. *puniceus* Mont. but which Montagne published as *M. atrorubens* Berk. on the faith of Berkeley's determination. I have not studied this in detail but it has very distant gills

with fusiform pleurocystidia and I suspect it to be *M. tageticolor* or some allied species.

The fungus Berkeley later called *M. atrorubens* from Ceylon also has a smooth stipe and is not that species. A collection from Ceylon made by Petch and deposited at Kew under this name is much more like the type,

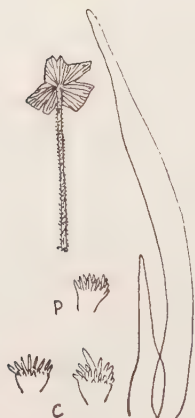


FIG. 1. *Marasmius atrorubens*. Sketch of type $\times 1$, hairs of the stipe, pilo- (P) and cheilocystidia (C) $\times 660$.

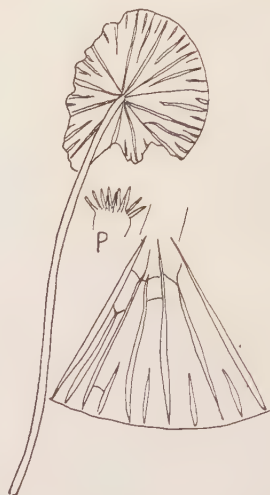


FIG. 2. *Marasmius bellus*. Sketch of type $\times 1$, part of gill plan enlarged, pilocystidium $\times 660$.

which Petch knew from the description only. The hairs of the stipe are browner and thicker walled, however, and, as Petch (1947) has already stated, similar brown setae occur among the cystides-en-brosse of the pileus surface. Evidently this is allied to Berkeley's type from Surinam but not identical with it, hence to avoid confusion I propose for the Ceylon fungus the name *Marasmius atrorubens* (Berk.) Berk. var. *setosus* var. nov. A typo differt pileo setoso. Typus : Royal Botanic Gardens, Peradeniya, Ceylon, 10-11 June, 1917, *Petch* 5176, in Herb. Kew.

***Marasmius bellus* Berk.** in Hooker's Journal of Botany **8**, 139 (1856).

Pileus diameter 2 cm., expanded, honey yellow (Ridgeway) when dry, gills subdistant, of two to three lengths, slightly interconnected, adnate to the apex of the stipe, narrow ; stipe smooth, hollow, russet above shading to dark brown below, base tawny-strigose ; pilocystidia 7μ diameter with processes about 5μ long, no pleurocystidia, spores not recovered ; trama deep red-brown in Melzer's reagent. Fig. 2.

Type : Panure, Brazil, Spruce unnumbered, on plant debris. This seems near to *M. leoninus* Berk., see also *M. floriceps* below.

***Marasmius chrysochaetes* Berk. et Curt.** in Journ. Linn. Soc. Bot. **10**, 297 (1869). *Crinipellis chrysochaetes* (Berk. et Curt.) Sing in Lilloa **8**, 461 (1942).

Pileus about $1\frac{1}{4}$ mm. diameter, now pinkish-buff (Ridgeway), sulcate-striate to the shallow umbilicus, with a small central dark brown umbo ; gills equal, broad, adnate to a collar ; stipe up to about 25 mm. long,

very slender and wiry, light brown, smooth ; pilocystidia 8–15 μ diameter bearing a few obtuse apical lobes, cheilocystidia similar, no pleurocystidia ; spores elliptic-cylindric 9–10 \times 3–3.5 μ ; trama very thin, deep red-brown in Melzer's reagent. The sporophores arise singly from dead leaves on which they are interspersed with short sterile strands, probably immature or abortive sporophores.

Type : *Wright* 162, Cuba. Fig. 3.

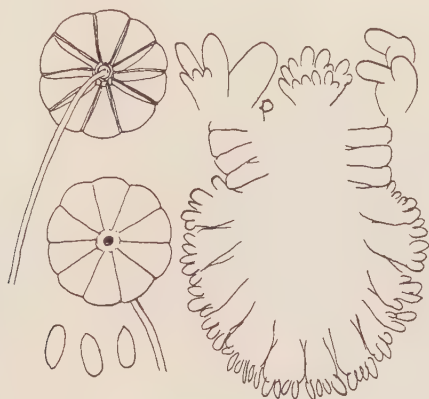


FIG. 3. *Marasmius chrysochaetes*, soaked up sporophores from the type \times 10, spores, section of gill edge and 3 pilocystidia \times 660.

Marasmius cladophyllus Berk. in Hooker's Journal of Botany 8, 138 (1856).

Pileus diameter about 1 cm., expanded, orange-rufous ; gills crowded, of two to three lengths, adnate to the apex of the stipe, narrow, closely and reticulately interconnected by veins up to about half as wide as the gills ; stipe 7 cm. long, dark brown, smooth, base slightly strigose ; pilocystidia and cheilocystidia 7–9 μ across with short ochraceous processes, no pleurocystidia ; spores not recovered ; tramal hyphae 4 μ wide, thin-walled, very dark red-brown in Melzer's reagent. The tips of a few of these dark staining tramal hyphae turn out into the hymenium but none have been seen to protrude as gloecystidia.

Type : *Spruce* 89, on a leaf, Panur , Brazil. Fig. 4.

From *M. polyporoides* Murr. this differs if at all in its darker smoother stipe. As only a single sporophore of *M. cladophyllus* was preserved and the smooth dark stipe may perhaps be due to age I feel it unwise to attempt to distinguish the two species unless and until these differences are confirmed by a long series of good fresh collections.

Marasmius cupressiformis Berk. in Hooker's Journal of Botany 8, 140 (1856).

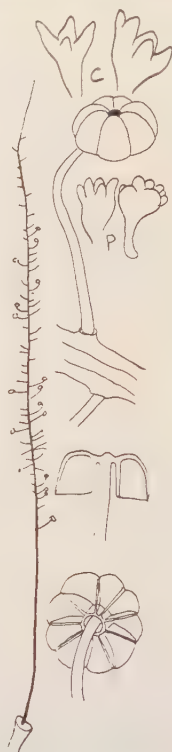
Pileus diameter $\frac{2}{3}$ mm., convex, white, sulcate-striate to the shallow umbilicus with low dark brown umbo ; gills equal, broad, adnate to a collar ; stipe dark brown, short, smooth ; pilocystidia and cheilocystidia 6–12 μ diameter, with few large lobe-like apical processes, no

pleurocystidia, spores not recovered; trama pale reddish-brown in Melzer's reagent. The sporophores arise in large numbers from a long,



FIG. 4. *Marasmius cladophyllus*. Sketch of type $\times 1$, gill plan $\times 6$, pilo- (P) and cheilocystidium (C) $\times 660$.

Right—FIG. 5. *Marasmius cupressiformis*. Sketch of type $\times 1$, sporophores and section $\times 20$, pilo- (P) and cheilocystidia (C) $\times 660$.



wiry, smooth, dark brown rhizomorph, $\frac{1}{2}$ mm. thick at the base, tapering to the apex, emerging in the type from the petiole of a fallen leaf.

Type : *Spruce 75*, Panuré, Brazil. Fig. 5.

***Marasmius dispar* (Mont.) Fr.** *Epicrisis* 382 (1838).

Agaricus dispar Mont. in *Ann. Sci. nat. Ser. 2*, **2**, 79 (1834).

Pileus about 4 mm. diameter, “d’un bai obscur et mat”, convex, with a small umbo, striate sulcate margin according to Montagne, though this is no longer very apparent; gills about 10, adnexed to the apex of the stipe without a collar, equal; stipe up to about 14 cm. long, reddish brown, smooth, wiry, inserted on a dead and fallen leaf, pilocystidia about 9μ diameter with short processes.

Type : near Rio de Janeiro, Brazil, *Gaudichaud 26*, in *Herb. Paris*.

M. dispar has already been well figured by Montagne, *op. cit.* t. 4 fig. 3. Its brown stipe and adnexed gills distinguish it from *M. polycladus* Mont. and *M. hippochaetes* Berk.

***Marasmius flammans* Berk.** in *Hooker's Journal of Botany* **8**, 136 (1856).

Pileus 22 mm. diameter, expanded, upper surface when dry now Burnt Sienna (Ridgeway), nearer Mars Orange when soaked up; gills subdistant, of two to three lengths, yellowish, adnate to the apex of the

stipe ; stipe cinnamon-rufous, 5 cm. \times 1 mm., smooth ; pilocystidia about 8μ diameter with numerous slender apical processes 6-13 μ long ; pleurocystidia thick-walled, pointed, fusiform or undulating setae rooted in the trama ; cheilocystidia thin-walled, ventricose, about $25 \times 4\mu$; trama of broad thin-walled, loosely woven hyphae deep red-brown in Melzer's reagent ; spores not recovered.

Type : *Spruce* 97, Panur , Brazil, on fallen leaves. Fig. 6.

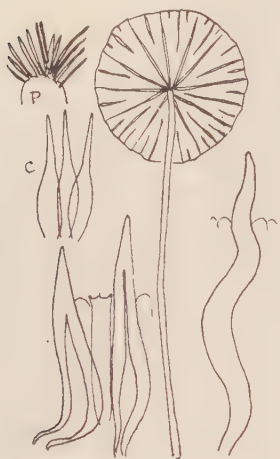


FIG. 6. *Marasmius flammans*. Sketch of type \times 1, pilo- (P), cheilo- (C) and pleurocystidia \times 660.

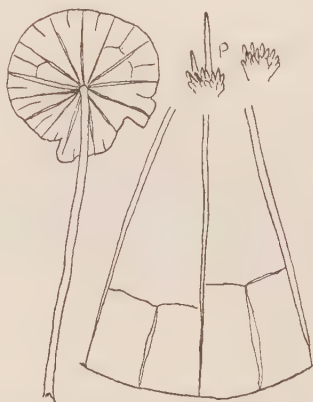


FIG. 7. *Marasmius floriceps*. Sketch of type \times 1, part of gill plan enlarged, pilocystidia \times 660.

Marasmius floriceps Berk. et Curt. in Journ. Linn. Soc. Bot. **10**, 298 (1869).

Pileus 2 cm. diameter, expanded, dark reddish-brown when dry ; gills distant, adnate, of two lengths, the shorter often connected at the inner end by veins to the longer ; stipe over 4 cm. \times 1 mm., the base missing, hollow ; pilocystidia 7-8 μ diameter with apical processes of different lengths, cheilocystidia not seen as the gills are much damaged by mites ; no pleurocystidia ; trama of broad, thinwalled, closely woven hyphae, red-brown in Melzer's reagent ; spores not recovered.

Type : *Wright* 31, Cuba. Fig. 7.

Marasmius fulvus Mont. apud Sacc. Syll. fung. **9**, 68 (1891).

The name *Marasmius fulvus* n. sp. in Montagne's writing is attached to a sporophore with fulvous pileus covered with cystides-en-brosse and a hairy stipe, attached to a fragment of wood collected by Leprieur in French Guiana and sent by Montagne to Berkeley. Berkeley published the name without description in listing *Spruce* 104 among the latter's fungi from Panur , Brazil, but this is a fungus with smooth stipe, translucent pileus and hyphal cuticle. Saccardo published a brief diagnosis apparently supplied him by Cooke, he calls the species "*M. fulvus* Mont. in herb. Berk., Cooke in litt.", which was evidently drawn up mainly from *Spruce* 104 as is shown by the characters "pileo membranaceo—stipite nudo" but he cited both localities, "Guyana,

Panuré" and hence by implication both Leprieur's and Spruce's specimens. As these clearly belong to different species the best course is probably to reject *M. fulvus* Mont. as a nomen confusum. If it be argued that the diagnosis may have been based solely on Spruce 104 and that the species should be retained with that as the type then it is not a *Marasmius* as here understood, nor can the name be attributed to Montagne.

***Marasmius hinnuleus* Berk. et Curt.** in Journ. Linn. Soc. **10**, 297 (1869).

Pileus 12 mm. diameter, expanded with a shallow umbo, colour approximately cinnamon rufous (Ridgeway); gills adnate to the apex of the stipe, subdistant, of two lengths; stipe about 3 cm. \times 1 mm., smooth, orange rufous, base strigose; pilocystidia about 8μ diameter with long reddish-brown processes; no cheilocystidia or pleurocystidia; spores not recovered; trama of closely woven thinwalled hyphae deep red brown in Melzer's reagent.

Type: *Wright* 155, on dead leaves, Cuba, October. Fig. 8. The collector's note of the fresh colour is "light reddish brown".



FIG. 8. Left: *Marasmius hinnuleus* sketch of type \times 1, part of gill plan enlarged, pilocystidium (P) and basidium (B) \times 660; Centre: *Marasmius rubricosus*, sketch of type in Herb. Montagne \times 1, details as before; Right: *Marasmius balsanae*, sketch of type in Herb. Spegazzini, details \times 660.

M. balsanae Speg. agrees in the unusual character of having no marginal cystidia on the gills and I suspect *M. rubricosus* Mont. 1854 is another and earlier synonym.

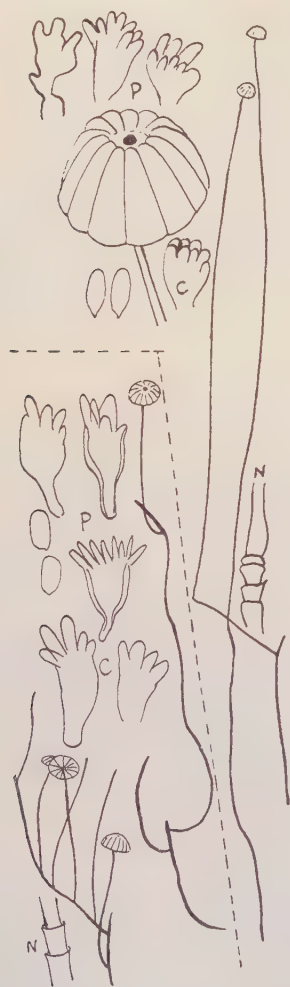
***Marasmius hippiochaetes* Berk.** in Hooker's Journal of Botany **8**, 139 (1856).

Pileus 3 mm. diameter, hemispherical, sulcate-striate to the shallow umbilicus with minute dark umbo, surface now dark purplish red, "pileus coccineus, hymenium pallidum" according to the collector's note; gills about 14 equal, the pileus cannot now be fully opened but from its shape there can be little doubt the gills are attached to a collar; stipes arising singly from sticks or petioles, whitish at the apex only, elsewhere almost black, smooth, very long and marked at intervals by

nodes which presumably indicate stages of growth, occasionally branched. Pilocystidia 7–10 μ diameter, crowned by a few large obtuse lobes, purplish red, cheilocystidia similar but a little paler, no pleurocystidia ; spores elliptical 9–10 \times 3–4 μ .

Type : *Spruce* 88, in lignis sylvorum fl. Uaupés, Brazil, March 1853. Fig. 9.

This is probably either a synonym or a colour variety of *M. polycladus* Mont. 1854 which was described as "pileus—fusco purpureus sanguineusve" and has the same peculiar pilocystidia and nodes on its thick rhizomorph.



Left—FIG. 9. Above: *Marasmius hippochaetes*, Two sporophores from the type \times 1, soaked up pileus and nodes of the stipe \times 7, pilo- (P) and cheilocystidium \times 660 ; Below : *Marasmius polycladus*, authentic material from Montagne in Herb. Berkeley, sporophores \times 1, details as before.

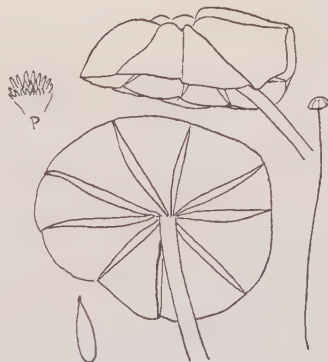


FIG. 10. *Marasmius inaequalis*. Sporophore from type \times 1, soaked up pileus \times 10, spore and pilocystidium \times 660.

Marasmius inaequalis Berk. et Curt. in Journ. Linn. Soc. Bot. **10**, 297 (1869).

Pileus about 2–3 mm. diameter, convex, sulcate-striate, white ; gills distant, about 10, equal, collar probably absent ; stipe wiry, smooth, up to 4 cm. long, yellowish above, brown below ; pilocystidia about 9 μ .

diameter with short colourless processes, cheilocystidia not demonstrated, no pleurocystidia ; trama unstained in Melzer's reagent ; spore tear shaped, $13 \times 3.5\mu$, only one seen.

Type : *Wright* 8, Cuba, sporophores solitary on wood and roots. Fig. 10.

If there is no collar round the apex of the stipe this may be a small state of *M. subrotula* Murr.

Marasmius mitiusculus *Berk.* in Hooker's London Journal of Botany **2**, 631 (1843).

The type sheet bears broken pieces of 6 sporophores firmly glued down. It is not possible to make from them a satisfactory reconstruction of the fungus but the following data are recoverable. Pileus about 6 mm. diameter, whitish, convex, slightly umbilicate, surface minutely tomentose ; gills equal, subdistant, adnate-decurrent to the apex of the stipe, rather narrow and attenuated at each end ; stipe about 2 cm. \times 1 mm., appearing finely tomentose under a lens but so mouldy I cannot judge its original condition ; pileus surface covered with short, slender, more or less clavate, nodulose hyphal branches, no pleurocystidia, gill edge probably sterile but no distinctive cheilocystidia seen, basidia about 5μ diameter, spores not recovered ; trama thin, of loosely woven nonamyloid hyphae about 3μ wide.

Type : Minas, Brazil, *Gardner* in Herb. Hooker and Herb. Berkeley.

Judging by the nodulose hyphae of the pileus surface this is akin to *M. nigripes* (Schwein.) Fr. and *M. praetortipes* Murr. The white pileus and distant gills suggest the latter.

Marasmius multiceps *Berk.* et *Curt.* in Journ. Linn. Soc. Bot. **10**, 298 (1869).

Pileus about 5 mm. diameter, white, expanded, striate-sulcate to the shallow umbilicus with hard low black umbo ; gills about 12-14, rather narrow, adnate to a shallow collar ; stipe blackish, smooth, wiry, arising from a similar smooth black rhizomorph about $\frac{1}{2}$ mm. thick ; pileocystidia 5-10 μ diameter with numerous slender processes 1-4 μ long, cheilocystidia similar, no pleurocystidia, spores not recovered, trama of closely woven thinwalled hyphae, light reddish-brown in Melzer's reagent.

Type : *Wright* 160, Cuba. Fig. 11.

Marasmius personatus *Berk.* et *Curt.* in Journ. Linn. Soc. Bot. **8**, 297 (1869).

Pileus about 10 mm. diameter, expanded, closely striate-sulcate, now brown, original colour uncertain ; gills crowded, of two lengths, adnate to the apex of the stipe ; stipe brown, smooth, hollow, longitudinally grooved when dry, base strigose ; pileocystidia 8-10 μ wide, colourless with short processes, cheilocystidia similar, no pleurocystidia ; spores not recovered ; trama deep red-brown in Melzer's reagent.

Type : *Wright* 10, on a leaf, Cuba.

Marasmius phaeus Berk. et Curt. in Journ. Linn. Soc. Bot. **10**, 298 (1869).

Pileus conical, up to about 1 cm. diameter, now dark purplish brown, striate-sulcate to the umbo ; gills about 10, narrow, attenuated at each end, very distant, adnate to the apex of the stipe, concolorous ; stipe smooth, dark brown, arising from a white mycelial web ; pilocystidia clavate, about $6-7\mu$ diameter, with slender processes $5-10\mu$ long, cheilocystidia similar; no pleurocystidia, basidia cylindrical, about $40 \times 5-6\mu$, trama reddish-brown in Melzer's reagent.

Type : Wright 18, on wood, Cuba. Fig. 12.

M. phaeus, *M. poecilus* and *M. tageticolor* seem closely allied.

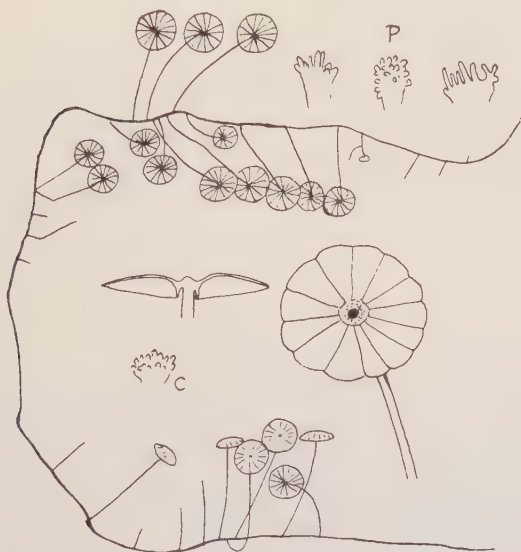


FIG. 11. *Marasmius multiceps*. Sketch of type $\times 1$, soaked up pileus $\times 4$, pilocystidium (P) and cheilocystidium $\times 660$.

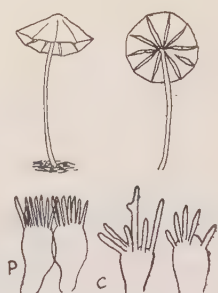


FIG. 12. *Marasmius phaeus*. Sketch of sporophore soaked up from type $\times 1$ pilocystidium (P) and cheilocystidia (C) $\times 660$.

Marasmius poecilus Berk. in Hooker's Journal of Botany **8**, 137 (1856).

Pileus conical to expanded, about 10 mm. diameter, hazel (Ridgeway) when soaked up, striate-sulcate to the umbo ; gills about 8, distant, narrow, attenuated at each end, adnate to the stipe ; stipe whitish at the tip, elsewhere very dark reddish-brown, smooth, base not strigose ; pilocystidia $7-8\mu$ wide with short reddish-brown processes, cheilocystidia similar, no pleurocystidia, spores not recovered, trama red-brown in Melzer's reagent. The sporophores occur singly on dead leaves.

Type : Spruce 139, in folius emortuis sylvarum, frequens, Panuré, Brazil, Feb. 1853. Fig. 13.

This species is distinguished from *M. ferrugineus* by the absence of pleurocystidia and from *M. helvolus* by the few distant gills.

Marasmius populiformis Berk. in Hooker's Journal of Botany **8**, 140 (1856).

Pileus about $\frac{1}{2}$ mm. diameter, convex, now dark brown, sulcate, striate to the shallow umbilicus with low dark umbo ; gills about 10, equal, adnate to a collar, whitish, edge concolorous with the pileus ; stipes short, yellowish, smooth, hollow, arising from a common rhizomorph which may be up to 10 cm. long and $\frac{1}{3}$ mm. thick, smooth, polished



FIG. 13. *Marasmius poecilus*. Sketch of sporophore from type $\times 1$, cheilocystidium $\times 660$.

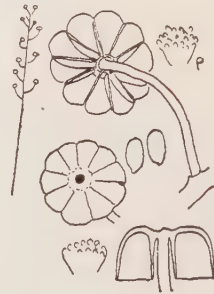


FIG. 14. *Marasmius populiformis*. Habit sketch of type $\times 1$, pilei and section $\times 25$, spores, pileo- (P) and cheilocystidium (C) $\times 660$.

and yellowish when dry ; pilocystidia about 8μ diameter with short reddish-brown processes, cheilocystidia similar, spores elliptical $7 \times 3\mu$.

Type : Panuré Brazil. Spruce's label reads " ? same as No. 75 " i.e. *M. cupressiformis* but it seems to be a distinct species. Fig. 14.

Marasmius proletarius Berk. et Curt. in Journ. Linn. Soc. Bot. **10**, 296 (1869).

Pileus 2–3 mm. diameter, convex white, closely sulcate-striate ; gills about 15, subdistant almost equal, adnexed, white, stipe reddish-brown, smooth, hollow ; pilocystidia about 10μ diameter, colourless with numerous short processes, cheilocystidia similar, no pleurocystidia, spores not recovered, trama of loosely woven thinwalled hyaline hyphae $5\text{--}6\mu$ wide, reddish-brown in Melzer's reagent. The sporophores are gregarious on dead wood.

Type : Wright 9 and 13 Cuba. Fig. 15.

Marasmius pusio Berk. et Curt. in Ann. Mag. Nat. Hist. Ser. 2, **12**, 427 (1853).

Pileus about 2 mm. diameter, light yellowish brown, convex ; gills very numerous, crowded, of two lengths, adnate to the stipe ; stipe short, concolorous, very minutely downy all over ; pilocystidia pyriform, with short obtuse processes, cheilocystidia similar, no pleurocystidia, caulo-

cystidia about $10-15 \times 4-5\mu$, clavate with rather long spinose processes ; trama of compact slender hyphae, spores not recovered.

Type : Curtis 2043, South Carolina, on bark, August. Fig. 16.

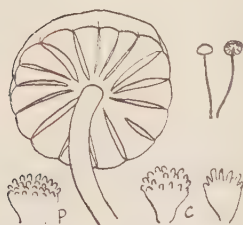


FIG. 15. *Marasmius proletarius*. Two sporophores from the type $\times 1$, soaked up pileus $\times 7$ pilo- (P) and cheilocystidia $\times 660$.

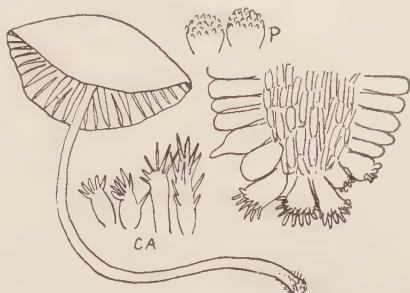


FIG. 16. *Marasmius pusio*. Sporophore from type $\times 12$, section of gill edge, pilo- (P) and caulocystidia $\times 660$.

This bears no resemblance to *M. graminum* (Lib.) Berk. with which Berkeley compared it but is probably identical with *M. tener*.

Marasmius tener Berk. et Curt. in Proc. Amer. Acad. Arts & Sci. **4**, 121 (1860).

Pileus about 3 mm. diameter, convex, white, drying yellowish ; gills numerous, of two lengths, adnate to the stipe ; stipe concolorous, minutely downy, arising from a web of white mycelium on wood ; pilocystidia $7-8\mu$ diameter with short processes, cheilocystidia similar, no pleurocystidia, caulocystidia $10-20 \times 3-5\mu$, bearing long processes or irregularly branched and forked, occasionally longer and pointed, spores not recovered ; trama red-brown in Melzer's reagent.

Type : United States Exploring Expedition, Bonin Isles, North Pacific. Fig. 17.

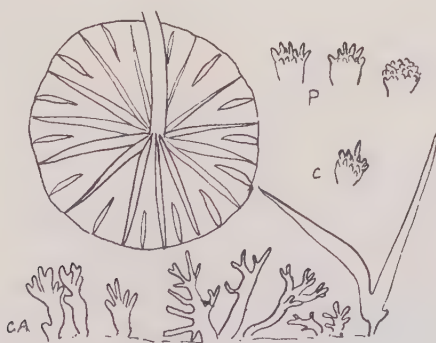


FIG. 17. *Marasmius tener*. Soaked up pileus from type $\times 10$, pilo- (P), cheilo- (C) and caulocystidia (CA) $\times 660$.

Wright 7 and 107 from Cuba, referred by Berkeley to this species, look similar.

NOTES ON CYPERACEAE : XXV.*

E. NELMES.

NEW LIBERIAN SPECIES OF CYPERUS AND ELEOCHARIS.

Among the *Cyperaceae* collected by Dr. J. T. Baldwin, Junior, in Liberia during 1947 are two species of *Cyperus* which appear to be new. One of these, which I have called *C. guineënsis*, has been previously collected by others in Sierra Leone and Nigeria, and the other, *C. immanis*, once before in Sierra Leone, but the Baldwin specimen of each is considered the best and has accordingly been chosen as the type.

There is no striking distinctiveness about *Cyperus guineënsis*, but *C. immanis* is a giant plant belonging to Sect. *Papyrus* (Willd.) C. B. Clarke, with even longer inflorescences than those of the large *C. elephantinus* C. B. Clarke, from Natal, to which it seems most closely akin.

Baldwin also collected, in 1949, a very interesting Liberian *Eleocharis*, which is the same species as a French Guinea plant collected by Caille and named in honour of the collector by Hutchinson, together with descriptive notes in English, in his *Flora of West Tropical Africa*, vol. 2, pp. 467, 468, 1936. A validating description is given below.

Eleocharis caillei shares with *E. naumanniana* Boeck. the very rare distinction of producing spikes which are only 1-flowered. Besides these two species, all the numerous others known, however small in size, and there is a considerable number of small species, bear spikes with more, usually many more, than one flower in each.

Svenson (*Rhodora*, 39 : 254 : 1937), comparing part of Caille's gathering given to him by Dr. Hutchinson with Boeckeler's description of *E. naumanniana*, came to the conclusion that the two were conspecific. I have had the greater advantage of seeing both the Caille material at Kew and specimens of *E. naumanniana* side by side, and have no doubt that the characters mentioned below in the diagnosis preceding the description of *E. caillei* separate it specifically from *E. naumanniana*. Besides the non-septate stems of *E. caillei*, its achene and style-base are markedly different from those of the other species. They are both aquatic plants, occurring in masses, often proliferating, and sometimes mixed with species of *Utricularia*.

Cyperus immanis Nelmes, sp. nov. ; a *Cypero elephantino* C. B. Clarke radiis longioribus erectis vel suberectis, spiculis tenuioribus, nucibus oblongis angustioribus distinguenda.

Rhizoma elongatum, curvatum, crassiusculum, lignosum. *Culmus* erectus, trigonus, angulis obtusis, lateribus excavatus, circiter 200 cm. altus, validissimus (inferne 12 mm. crassus), laevis, basi foliatus. *Folia* culmo breviora, usque 25 mm. lata, planiuscula vel marginibus revoluta, longe attenuata, rigidula, septato-nodosa, inferiora ad vaginas redacta. *Bractee* circiter 6, foliaceae, erectae vel suberectae, inferiores anthelam superantes ; *bracteolae* minores. *Anthela* composita, circiter 9-radiata ; *radii* inaequales, usque circiter 80 cm. longi, validuli, compresso-trigoni, laeves, erecti vel suberecti. *Anthelulae* pluri-radiolatae ; *radioli* inaequales usque 27 cm. longi, graciles, compresso-trigoni, laeves, erecti vel

*Continued from Kew Bull, 1950, 208.

suberecti. *Spicae* plus minus oblongo-cylindricae, 4-16-spiculatae. *Spiculae* erectae, lineares, 5-15 mm. longae, circiter 0.5 mm. latae, subteretes, 6-12-florae. *Rhachilla* alata; *alae* hyalinae, demum solutae. *Glumae* laxae dispositae, oblongo-ellipticae, valde incurvae, basi truncatae, apice obtusae vel subacutae, 2-2.3 mm. longae, 0.8-1 mm. latae, membranaceae, tenuiter nervosae, sordide brunneae, lateribus enerves, pallidiores, apicem versus late albo-hyalinae, muticae, nervo mediano vix carinato apicem haud vel vix attingente. *Stylus* basi leviter incrassatus, subpersistens. *Stigmata* 3. *Nux* oblonga, trigona, lateribus plana vel concaviuscula, 1.25-1.5 mm. longa, 0.4-0.5 mm. lata, demum brunnea vel fusca, minute punctulata, haud vel vix apiculata.

SIERRA LEONE : Marigot près de Kancaro, entre Masodon et les Mts. Loma, 6 Aug. 1945, *Jaeger* 897 !

LIBERIA : Western Province ; Vonjama District, Vonjama, 22 Oct. 1947, *Baldwin* 12044 (typus, Herb. Kew.) !

Cyperus guineënsis *Nelmes*, sp. nov. ; a *Cybero zollingeri* Steud. culmis validis, foliis latioribus, spiculis brevioribus latioribus, glumis haud adpressis distinguenda.

Rhizoma breve, lignosum. *Culmi* erecti, trigoni, angulis superne acuti, 62-80 cm. alti, validi, basi leviter incrassati, laeves, inferne foliati. *Folia* culmo longiora, 6-9 mm. lata, planiuscula vel marginibus revoluta, longe attenuata, rigidula; *vaginae* longae, membranaceae. *Bractaeae* 3-5, foliaceae, erectae vel suberectae, inferiores anthelam superantes. *Anthela* composita, 6-9-radiata; *radii* inaequales usque 16 cm. longi, graciles, triquetri, laeves, erecti vel patuli, apice corymboso-ramosi; *radioli* usque 6 cm. longi, patuli. *Spicae* plus minus late ovatae, laxae 4-14-spiculatae. *Spiculae* suberectae vel subpatentes, lineari-lanceolatae, 10-15 mm. longae, 2-3 mm. latae, subcompressae, 5-12-florae. *Rhachilla* flexuosa, alata; *alae* hyalinae, demum solutae. *Glumae* subdense imbricatae, ellipticae, valde incurvae, basi truncatae, apice obtusae, 3-4 mm. longae, circiter 2 mm. latae, membranaceae, medio nervosae, virides vel flavo-virides, lateribus saepissime rubidae, enerves, marginibus anguste vel late albo-hyalinae; *carina* plerumque mucronata. *Stigmata* 3, tennes. *Nux* ellipsoidea vel obovoideo-ellipsoidea, trigona, lateribus excavatis, circiter 1.5 mm. longa, 0.7-0.9 mm. lata, demum brunnea, minute punctulata, brevissime apiculata.

SIERRA LEONE : Prairie sommet de Peronkonko, Loma Mts., 19 Sept. 1945, *Jaeger* 1766 !

LIBERIA : Western Province ; Vonjama District ; Vonjama, 22 Oct. 1947, *Baldwin* 9901 (typus, Herb. Kew.) !

NIGERIA : Ondo Province ; Idanre Hills, Orosan Peak, on *Loudetia* mat on bare rock, 31 Oct. 1948, *Keay* (FHI 22677) !

Eleocharis caillei *Hutch. ex Nelmes*, sp. nov. ; ab *E. naumanniana* Boeck. culmis haud septatis, acheniis minoribus sub apice constrictis ipso apice expansis discoideo-annulatis, stylo basi angustissime pyramidalis distinguenda.

Dense caespitosa. *Culmi* numerosissimi, elongati, filiformes, sulcato-compressi, flaccidi; *vaginae* membranaceae, marcescentes. *Spiculae* sub anthesi lineares, sub fructu lanceolatae, interdum proliferae, 3-4 mm.

longae, 1-florae. *Glumae* 2-3, lanceolatae, acuminatae, circiter 3 mm. longae, tenuiter membranaceae, virides sed margines versus rubidae, marginibus ipsis albo-hyalinae involutae, dorso tenuiter carinatae. *Achaenium* 1, ellipsoideum, trigonum, angulis prominentibus, cancellatum, longitudinaliter tenuiter nervosum, stramineum, demum fuscum, 1-1.5 mm. longum, 0.6-0.8 mm. latum, basi et sub apice constrictum, apice ipso expansum, truncatum, discoideo-annulatum. *Stylus* basi tenuiter pyramidalis. *Setae* 0.

FRENCH GUINEA : *Caille* 14957 (typus, Herb. Kew. ; Herb. Chevalier., Paris) !

LIBERIA : Montserrado Co., in pools and streams of savannah region, about 20 miles east of Monrovia, very common, 20 Aug. 1949, *Baldwin* 13049b (Herb. Kew., Herb. Stockholm., Herb. Williamsburg., Va.) !

SOME NEW SPECIES OF INDIAN GRASSES.

N. L. BOR.

Eragrostis burmanica Bor, sp. nov. *E. chariis* (Schult.) Hitchc. similis sed pedicellis multo longioribus facile distinguitur.

Gramen perenne. *Culmi* usque 60 cm. alti, teretes, striatuli, laeves glabrique, nodis glabri. *Foliorum laminae* superiores usque 15 cm. longae, basi 6 mm. latae, planae vel in siccitate convolutae, in apicem acutum attenuatae, subtus glaberrimae, laevissimae, supra pilis brevibus albis numerosis tectae, vaginarum inferiorum eae lineares, planae, utrimque glabrae, supra marginibusque minutissime scaberulae, subtus laeves ; *vaginae* inferiores brevissimae, valide carinatae, laeves, glabrae, nitentes ; superiores longiores, arctae, laeves, carinatae ; *ligula* fere abest.

Panícula usque 35 cm. longa, 15 cm. lata, late elliptica, laxa, nutans, ramis late patentibus ; rhachis minutissime scaberula, nodis pilosa ; rami solitarii, scaberuli, gracillimi, laxè divisi ; ramuli gracillimi spiculas longi-pedicellatas gerentes ; pedicelli 1-2 cm. longi, capillares, scaberuli, apicibus dilatati. *Spiculae* oblongo-obtusae, circa 12-16-florae, lateraliter compressae, 5-6 mm. longae, 1.5 mm. latae, stramineae vel nigrescentes ; rhachilla persistens, glabra ; paleae cum lemmatibus solutae. *Gluma inferior* 1 mm. longa, elliptico-acuta vel lanceolato-acuta, membranea, 1-nervis, carinata, carina scaberula, laevis glabraque. *Gluma superior* 1.5 mm. longa, 1-nervis, oblongo-acuta, carina scaberula, ceterum laevis glabraque. *Lemma* 1.5 mm. longum, firme membranaceum, explanatum 1.5 mm. latum, late ovatum, acutum, dorso minute scaberulum, 3-nerve, carinatum, carina scabrum ; *palea* lemmati aequilonga, 2-carinata, carinis scabra ; *antherae* 0.4 mm. longae ; *caryopsis* 0.75 mm. ambitu ellipsoidea, rubra.

BURMA : Prome District, 20 Jul. 1948, *U Thein Lwin* 582, " at the edge of paddy fields " (typus in Herb. Kew.).

Digitaria stewartiana Bor, sp. nov. *D. curvinervi* (Hack.) Fernald et *D. caledonicae* Henr. similis sed ab illa rhachide late alata nec filiforme et ab haec spiculis majoribus et rhacheos ala latiore et ab ambabus racemis brevioribus recedit.

Gramen humile, annuum. *Culmi* usque 15 cm. alti, erecti vel basi prostrati, striati, teretes, ex vagina superiore anthesi longi-exserti, glaberrimi, laeves. *Foliorum laminae* lineares, basi rotundatae, in apicem acuminatum longe attenuatae, glabrae laevesque vel utrinque minute scaberulae, marginibus scaberulae, 6 cm. longae, usque 5 mm. latae, virides haud glaucae, nervo medio prominente. *Vaginae* laxiusculae, superiores culmum amplectentes, inferiores a culmo solutae, laeves glabraeque, striatae, carinatae, marginibus hyalinae. *Ligulae* membranaceae, truncatae, 1-1.5 mm. longae.

Racemi paniculae duo digitati vel tres; tertius racemus inferior, solitarius; axis usque 6 mm. longus, glaber, laevis, angulatus; racemi usque 4.5 cm. longi; rhachis glabra, laevis, 1-1.5 mm. lata, late alata; *spiculae* elliptico-acutae, a latere visae plano-convexae, glaberrimae, 1.5-2 mm. longae, 1 mm. latae, pedicellatae, a pedicello solutae, ternatae; pedicelli usque 2.5 mm. longi, laeves glabrique, apice dilatati. *Gluma inferior* deest. *Gluma superior* spicula brevior, paene 1.75 mm. longa, hyalina, 3-nervis, late ovato-elliptico-obtusa, laevis, glabra, nervis anastomosantibus. *Anthoecium inferius* vacuum; *lemma* spicula paullo brevius vel aequilongum, elliptico-obtusum, 5-nerve, laeve, glabrum, membranaceum, pellucidum, nervis tribus medianis parallelibus, omnibus anastomosantibus; *palea* deest. *Anthoecium superius* ♀; *lemma* spiculae aequilongum, chartaceum, ambitu elliptico-acutum, brunneo-nigrum, longitudinaliter striatum, glaberrimum, laevissimum, nitens; *palea* chartacea, brunneo-nigra. *Stamina* 3; *antherae* 0.5 mm. longae (cleistogamae). *Caryopsis* elliptica, 1.25 mm. longa.

IND. OR. Kashmir: Chunagund, near Kargil, Ladak, 3,200 m., 25 Aug. 1940, R. R. Stewart 21047 (typus in Herb. Kew.).

This species belongs to a group called *Atrofuscae* by Dr. Henrard, the characteristics of which, to paraphrase slightly Dr. Henrard's description, are as follows. Spikelets rather small, 1.5-2 mm. long, perfectly glabrous; lower glumes always absent, upper glume often as long as, or slightly shorter than, the lower lemma, rarely only half as long as the spikelet; fruit mostly very dark, purplish, or sometimes brown, broadly ovate or obovate, rarely elliptic. Delicate annual plants or a single one perennial.

This species comes nearest to *D. curvinervis* (Hack.) Fernald and to *D. caledonica* Henr. both of which it resembles in the general characters mentioned above. In addition all three possess the peculiar translucent upper glume with the three nerves anastomosing below the rounded or acute tip.

A characteristic of *D. stewartiana* is that the rhachis of the racemes is broadly winged, but the wing is much broader than that in *D. caledonica*. The wing is sufficient to distinguish it from *D. curvinervis*, while the racemes are fewer in number and much shorter than in both the related species.

Henrard's remark that the "species are endemic and very local" is so far borne out by the distribution of *D. stewartiana*, which has been found only in Ladak, thousands of miles away from its nearest relatives.

Ophiuros bombaiensis Bor, sp. nov. ab speciebus annuis hujus generis foliorum laminis linearibus, spiculae gluma inferiore laeve vel foveolata

vel verrucosa, apice anguste alata, inflorescentiae pedunculo albo-piloso satis recedit.

Gramen annuum. *Culmi* tenues, usque 35 cm. alti, erecti, striatuli, infra paniculam longis pilis albis tecti, nodis glaberrimi. *Foliorum laminae* angustae, lineares, in apicem acuminatum attenuatae, usque 15 cm. longae, usque 8 mm. latae, planae, utrinque glaberrimae, nervis obscure tessellatis; *vaginae* glaberrimae, striatae a culmis demum solutae, internodiis breviores; *ligula* membranacea, hyalina, truncata, 1 mm. longa, margine superiore denticulata.

Spicae in apice culmi ramorumque solitariae, cylindricae, pedunculo piloso; rhacheos fragillimae articuli 3 mm. longi, facie profunde excavati, sectione semicirculares, glaberrimi, recte disjungentes, apice cavum rotundum basi umbilicum exhibentes (umbilicus basi articuli superioris in cavo apice articuli inferioris insedit) callo angusto semilunare. *Spiculae* ad quemque rhacheos nodum solitariae, 2.5 mm. longae, sessiles, biflorae, rhacheos excavationem exacte occludentes. *Gluma inferior* spiculae aequilonga, coriacea, glaberrima, convexa, margine angustissime leviterque inflexa, oblongo-obtusa, apice utrinque alis angustis instructa, dorso laevis vel 7-costata vel seriebus 7 fovearum profundarum costis rectis 7 divisarum ornata vel inter foveas verrucorugosa, anthesi patentissima; *gluma superior* 2.5 mm. longa, navicularis, 3-nervis, hyalina, glaberrima. *Anthoecium inferius* ♂; *lemma* 2.5 mm. longum, lanceolato-acutum, hyalinum; *palea* angustior, aequilonga, hyalina; stamina 3; antherae 1.5 mm. longae. *Anthoecium superius* ♀; *lemma* 2 mm. longum, hyalinum, exaristatum; *palea* paullo brevior angustiorque; styli 2; stigmata plumosa, purpurea.

IND. OR. Madras: Talyuppa Mysore, 600–1000 m., Oct. 1908, *A. Meebold* 10764 (typus in Herb. Kew.),

Bombay: Siddhapur, 500 m., Oct. 1917, *L. J. Sedgwick* 7018. "In rice fields".

This interesting annual, while it possesses the inflorescence of a typical *Ophiuros*, has a lower glume to the spikelet which is strongly reminiscent of that in *Coelorhachis*. The surface of the lower glume, however, varies in a remarkable way from smooth to foveolate and then to verrucose-foveolate, in succeeding spikelets from below upwards. All spikes do not show this sequence in its entirety, but at least from below upwards there is always an increasing degree of complexity, a feature which is not found in its nearest relatives in *Ophiuros*.

It is perhaps of interest to record here that another annual species of *Ophiuros*, *O. papillosus* Hochst. is also found in Bombay. This East African species is not recorded in the Flora of British India and is therefore new to India and apparently has only been collected once. The specimen is in the Blatter Herbarium in St. Xavier's College, Bombay—it is not localised.

Apocopis pulcherrimus Bor, sp. nov. ab *A. cochinchinense* A. Camus, gluma inferiore obcordata longiore latioreque, arista duplo longiore distinguitur.

Gramen annuum multis culmis floriferis. *Culmi* usque 20 cm. alti, ramosi, teretes, striati, laeves glabriusculi, basi geniculati. *Foliorum*

laminae superiores vestigiales, inferiores lineares, acutae, flaccidae, virides, utrimque longis vel brevissimis pilis e tuberculis ortis adpersae, usque 6 cm. longae, 5 mm. latae ; *vaginae* laxissimae, laeves glabraeque, striatae, valde carinatae ; *ligulae* angustissimae, membranaceae, 0.5–0.75 mm. latae, rotundato-truncatae.

Racemi gemini, pedunculo communi brevissime exserto fulti, usque 3 cm. longi, demum paullo divergentes ; pedunculus usque 5.5 cm. longus, laevis, glaber, vagina superiore tectus. *Spiculae* sessiles, ad quemque rhacheos nodum solitariae, pedicellatae enim ad merum pedicellum brevem redactae ; *rhachis* fragilis ; *articuli* rhacheos 2 mm. longi, angulati, angulis pilis longis aureo-brunneis ciliati ; *pedicellus* ad stipitem applanatum redactus, marginibus pilis aureo-brunneis usque 3.5 mm. longis ciliatus ; *gluma inferior* 5.5 mm. longa, 4 mm. lata, obcordato-oblonga, membranacea, marginibus apiceque hyalina, 7-nervis, apice ciliata ; *gluma superior* 5.75 mm. longa, explanata oblonga, 3-nervis, membranacea, marginibus hyalina, apice ciliata. *Anthoecium inferius* ♂ vel vacuum ; *lemma* 5 mm. longum, hyalinum ; *palea* similis ; *stamina* 2 ; *antherae* 0.75 mm. longae. *Anthoecium superius* ♀ ; *lemma* 5.5 mm. longum, 1 mm. latum, oblongum, valde 1-nerve, chartaceum, minutissime bilobatum ; *palea* hyalina, oblongo-truncata, 4 mm. longa ; *stamina* 2 ; *antherae* 2.5 mm. longae ; *stylis* duo, longi ; *stigmata* plumosa ; *arista* circiter 4 cm. longa ; *columna* brunnea, torta, circiter 1.8 cm. longa, brevissime hirsuta.

BURMA : Tatkon, 1928, *D. Rhind* 959 (typus in Herb. Kew.).

A very distinct and handsome plant with thick spikes and very long awns.

Apocopsis burmanicus *Narayanaswami* sp. nov. ab *A. cochinchinense* A. Camus nervis minimum duobus glumae inferioris apicem attingentibus inter alia recedit.

Gramen annuum. *Culmi* usque 20 cm. alti, basi repentes, decumbentes, ramosi, glabri laevesque, teretes, graciles, striati, nodis glabri. *Foliorum laminae* usque 3.5 cm. longae, 4 mm. latae, lineari-acutae vel -acuminatae, ascendentes neque patulae, flaccidae, utrimque pilis basi tuberculatis obsitae, marginibus utrimque minutissime scaberulae ; pili demum decidui ; *vaginae* arctae, carinatae, internodiis breviores, striatae, marginibus scariosae, inferne glabrae laevesque, superne pilis basi tuberculatis obsitae ; *vaginae* superiores laminam vestigialem gerentes ; *ligula* membranacea, lacerata, 0.75 mm. longa.

Racemi gemini, usque 3 cm. longi, fragiles. *Spiculae* ad quemque rhacheos nodum solitariae ; *articuli* 1.25 mm. longi, compressi, superne latiores, marginibus pilosi, interne glabri, externe apicem versus minutissime pilosi ; pili fulvo-brunnei. *Spiculae* hermaphroditae, callo longibarbatatae. *Gluma inferior* 3–4 mm. longa, 2 mm. lata, oblongo-truncata, apice marginibusque anguste hyalina, 7-nervis, nervis minimum duobus (nervo mediano incluso) apicem denticulatum attingentibus, juventute inferne longe pilosa, senectute glabra, fulva demum castaneo-brunnea ; *pedicellus* glumae adhaerens, 1.25 mm. longus ; *gluma superior* 3.5 mm. longa, 2.5–3 mm. lata, oblonga-truncata, 3-nervis, glabra, laevis, dorso minutissime scabra, fulva vel brunnea. *Anthoecium*

inferius masculinum ; *lemma* hyalinum, nerve, 3 mm. longum, elliptico-oblongum, truncatum ; *palea* similis sed angustior. *Anthoecium superius* femininum ; *lemma* 4 mm. longum, angustissimum, 1-nerve ; nervus ex apice 2-denticulato in aristam validam productus ; *palea* lata, 2 mm. longa, 2 mm. lata, nervis, hyalina ; *arista* 18 mm. longa ; *columna* 9 mm. longa, torta, brevissime pilosa. *Spicula pedicellata* abest ; *pedicellus* 1.25 mm. longus.

BURMA : Rangoon Lake, December 1876, *S. Kurz* 2749 (typus in Herb. Kew.) ; Pegu, Gonmin-In grazing ground, 20 Jan. 1948, *U. Thein Lwin* 453, "fairly common on shallow coarse or fine sand" ; South Pegu Division, Road near Wakadon, Lahu Reserve, *U Thein Lwin* 69.

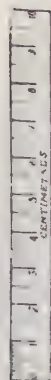
This plant was named in mss. some ten years ago by Mr. Narayanaswami of the Botanical Survey of India. He has not published a description in the meantime and the omission is rectified here.

This graceful slender grass is easily recognised by the upper denticulate margin of the lower glume of the sessile spikelet and by the nerves of the glume not being raised or prominent.

Heteropogon fischerianus Bor, sp. nov. ab omnibus speciebus adhuc descriptis foliorum laminis rigidis, complicatis, falcatis, distiche patentibus, internodiis brevissimis 5 mm. longis inter alia satis distinguitur.

Gramen perenne, dense caespitosum. *Culmi* multinodes, vaginis vetustis inferne obtecti, paniculam infra puberuli, ceterum glaberrimi, laeves, rigidi, nitidi, fere solidi, nodis barbati vel subglabri. *Foliorum laminae* pleraeque culmi media tertia parte congregatae (internodiis 5 mm. longis) explanatae lineares, manifeste distichae, rigidae, 2.5–7 cm. longae, complicatae, a latere visae falcatae, basi pilis paucis e tuberculis ortis praeditae, utrimque marginibusque apicem versus scabrae, supra minutissime pilosae, costa mediana valida, marginibus cartilagineis ; *vaginae* circiter 2.5 cm. longae, imbricatae, valide compressae, carinatae, distichae, manifeste striatae, glabrae laevesque ; *ligula* 1 mm. longa, in seriem densam ciliorum soluta.

Racemi in apice culmorum solitarii, 4–5 cm. longi, multi-articulati, articulis linearibus, inter spiculas superiores ciliatis obliquissime disjunctis, inter inferiores scaberulis haud disjunctis. *Spicularum* paria 4–6 inferiora homogama, masculina vel neutra ; spiculae sessiles parium superiorum femininae, subcylindricae, aristatae ; spiculae pedicellatae spiculis inferioribus similes sed longiores, masculinae ; pedicelli 1.5 mm. longi. *Paria homogama* ; articuli 3 mm. longi, apice crassiusculi, scaberuli. *Spicula sessilis* ; *gluma inferior* 7 mm. longa, 2 mm. lata, lanceolato-acuta, bicarinata, carinis anguste alata, marginibus involutis, multinervis ; *gluma superior* 6 mm. longa, 1 mm. lata, anguste elliptico-acuta, 3-nervis, marginibus superne ciliata ; *anthoecium inferius* vacuum ; *lemma* 5.5 mm. longum, marginibus ciliatum, ellipticum, hyalinum ; *palea* nulla ; *anthoecium superius* masculinum ; *lemma* 4.5 mm. longum, lanceolatum, hyalinum ; *palea* nulla ; *stamina* 3 ; *antherae* 2.5 mm. longae ; spicula pedicellata spiculae sessili similis, sed gluma altero margine late alata. *Spiculae heterogamae* ; spicula sessilis teres, atrofusca, callo curvato, 2.5 mm. longo, rufo-barbato, pungente ; *gluma inferior*, 6–6.5 mm. longa, apice truncata, teres, lateribus rotundata,



FLORA OF

No. Name

1. 1. 1.

Date: 1928

Altitude

Note

Collector: D. RHIND

No. 959

Apocopsis pulcherrimus Bor.*Apocopsis pulcherrimus* Bor.

[To face page 170]



Heteropogon fischerianus
Bor

DEL. *[signature]* 1051

HERBARIUM KEWENSE

Herbarium of Sir A. G. and Lady BOURNE.
Presented 1. 1915.

Andropogon carolinus L.
"formosa" Willd.
Kodakanal - Pulney.
1 July 1901.

Bourne 2111

Heteropogon fischerianus Bor

cartilaginea, brunnea demum atrofusca, breviter pilosa, bisulcatula ; *gluma superior* aequilonga, lateribus late hyalina, 3-nervis, media pars cartilaginea, brunnea, scabra ; *anthoecium inferius* vacuum ; *lemma* parvum, hyalinum, lanceolatum ; *palea* nulla ; *anthoecium superius* ♂ ; *lemma* ad basin aristae validae redactum, cartilagineum ; *palea* nulla ; *arista* valida, fere 6 cm. longa, ejus columna 3·4 cm. longa, villosa ; *styli* 2 ; *stigmata* longa, purpurea. *Spicula pedicellata* spiculae homogamae sessili similis sed longior.

IND. OR. : Madras, Kodaikanal, Pulneys, "Fairly Falls", 27 Apr. 1898, *Bourne* 1207 ; "Jesmond Hill", 1 Jul. 1901, *ibid.* 2025 (typus in Herb. Kew.) ; *ibid.* 2026 ; Poonachi, Annamalais, 10 Oct. 1901, C. A. Barber.

This very distinct and remarkable species of *Heteropogon* was considered by Fischer to be merely a variety of *Heteropogon contortus* (Linn.) P. Beauv. to which he gave the name var. *distichus* C. E. C. Fischer. The habit of the species is, however, so unique and, moreover, the spikelets smaller than those of *Heteropogon contortus*, that there is no doubt that this plant merits specific rank.

The numerous distichous leaves crowded together in the middle third of the culm distinguishes *H. fischerianus* from all other species of *Heteropogon*.

THE IDENTIFICATION OF RHYNCHOSIA CARIBAEA (JACQ.) DC. AND ALLIED SPECIES.

R. D. MEIKLE.

Rhynchosia caribaea (Jacq.) DC. was first described as a *Glycine* species in Jacquin's *Collectanea* **1**, 66 (1786), where the description is said to be based on cultivated material, grown from seed collected by the author "ex insulis Caribaeis". An excellent figure of the plant appeared soon afterwards (probably during the year 1787), in the same author's *Icones Plantarum Rariorum*, **1**, t. 146. *Glycine caribaea* Jacq. was transferred to the genus *Rhynchosia* by A. P. de Candolle in 1825 (*Prodromus* **2**, 384) and two additional localities, the R. Orinoco and western Florida, cited under the name.

There can be no doubt that the plant described by Jacquin in 1786 and the plant figured in his *Icones* are identical, and it is equally certain that De Candolle had the same species in mind when he transferred it to *Rhynchosia*, though he may not have seen an authentic specimen, for his description is taken, almost completely, from that given by Willdenow in his *Species Plantarum* **3**, 1064 (1803).

The plant figured by Jacquin is distinguished from the majority of *Rhynchosia* species in having unusually long, lax racemes, several of which are furnished with a patent lateral branchlet. This, together with the additional characters shown in the carefully depicted leaves, flowers and thinly pilose pod, are sufficient to make *R. caribaea* a distinct and readily recognizable species. The subsequent history of *R. caribaea*, however, involves a remarkable series of errors and misidentifications, due partly, perhaps, to an initial mistake in the localization of the type material, but

largely to the failure of later authors to pay proper regard to Jacquin's description and illustration. A detailed account of these errors will not be given, it is sufficient to say that after careful examination of *Rhynchosia* material at Kew and elsewhere, I am satisfied that *R. caribaea* is not, despite its name, an American plant, but a native of South Africa, ranging from Cape Province northwards to Mozambique and Southern Rhodesia. It is not found outside this area, except possibly as an introduction.

It must be remembered that Jacquin described *R. caribaea* from cultivated material, not from a dried specimen collected in the Caribbean area, and one can only assume that a misplaced label, or perhaps a faulty memory, was responsible for the erroneous localization, and for the misleading specific epithet. Whatever the case, no species of *Rhynchosia* agreeing with *R. caribaea* is to be found in the New World, and American specimens formerly so named are now, with general agreement, assigned to *R. phaseoloides* (Sw.) DC., *R. Swartzii* (Vail) Urb. or some other species.

The situation in Tropical Africa is not so satisfactory—here *R. caribaea* still appears as a common plant in the majority of regional floras, though an examination of the specimens cited usually fails to disclose anything approaching in appearance the plant described by Jacquin. The error would appear to have originated in Guillemain, Perrottet and Richard's *Florae Senegambiae Tentamen*, 213 (1830–33) where *Glycine sublobata* Schumach. is reduced to synonymy under *R. caribaea*. *Glycine sublobata* is, in fact, quite a distinct plant, and it is surprising that the two species should have been confounded, though perhaps even more surprising that the error should have persisted, undetected, to the present day. Evidently *R. caribaea*, once admitted to the Tropical African flora, came to be regarded as an "omnibus" species, into which all manner of doubtful or difficult *Rhynchosias* could be conveniently thrust, for, in addition to *Glycine sublobata*, the name *caribaea* has at different times been applied to numerous African species, many already described as distinct, others still awaiting names. The re-examination of Tropical African material thus necessitates the resuscitation of two forgotten epithets, to be listed below. The undescribed species will be dealt with, it is hoped, in a subsequent paper.

In South Africa true *R. caribaea* (Jacq.) DC. appears to be a widespread and fairly common species. It is a distinctive plant, and, although variable within well-defined limits, most of the material examined matches well with Jacquin's description and figure, and with old specimens, some of which must undoubtedly have been derived from seed of the plant originally described. The majority of the South African sheets of *R. caribaea* are correctly named, but one distinct species, to be described below, has been wrongly included under the name, and a few specimens of *R. (Glycine) sublobata* have been misidentified. In Southern Rhodesia, true *caribaea* has been re-described as *Rhynchosia gazensis* Bak. f.

It is hoped that the following treatment of *R. caribaea* will help to remove at least some of the errors which have hitherto obscured the species. Four distinct species and one variety are differentiated, the synonymy, geographical distribution and chief distinguishing characters of each of these being added as an aid to future identification.

In conclusion the author expresses his gratitude to the authorities at Copenhagen and the Linnean Society of London for their kindness in making available several important and interesting specimens.

(In the text, K.= Kew herbarium ; C.= Copenhagen herbarium ; Linn.=herbarium of the Linnean Society, London).

Rhynchosia caribaea (Jacq.) DC., Prod., **2**, 384 (1825).

Glycine caribaea Jacq., Collect., **1**, 66 (1786) ; Icon. Pl. Rar., **1**, t. 146 (? 1787).

Rhynchosia gibba E. Mey. in Linnaea, **7**, 170 (1830) ; Harv., in Fl. Cap., **2**, 255 (1862).

R. acuminata Eckl. & Zeyh., Enum. Pl. Afr. Austr., 253 (1836).

Copisma gibbum (E. Mey.) E. Mey., Comment. Pl. Afr. Austr. **1**, fasc. 1, 137 (1836).

[*Rhynchosia flavissima* (non Hochst. ex Bak.) Bak. f. in Journ. Linn. Soc., **40**, 59 (1911)].

R. gazensis Bak. f., Legum. Trop. Afr., 475 (1929).

A perennial twiner ; stems slender, pubescent. Upper surface of leaflets sparsely pubescent or subglabrous ; lower surface pubescent on nerves and veins, dotted over with raised golden glands ; mid-leaflets

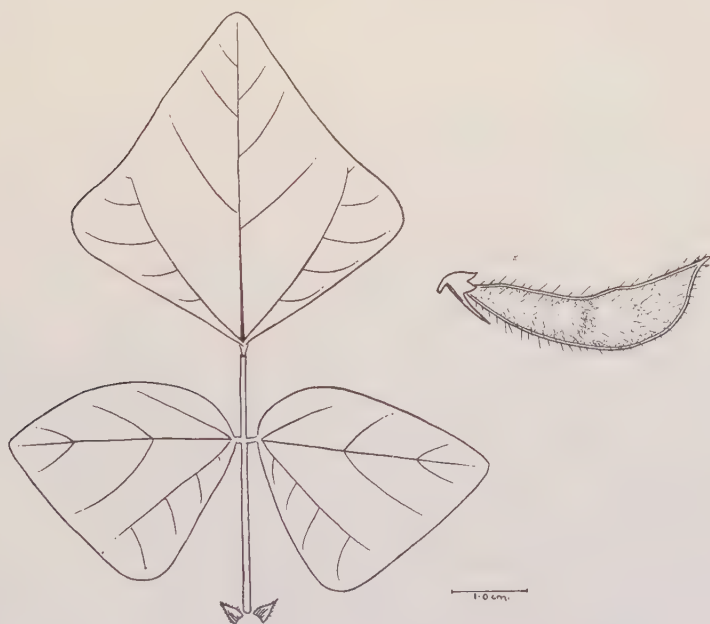


FIG. 1. *Rhynchosia caribaea* (Jacq.) DC. Leaf, stipules and pod.

broadly rhomboid or deltoid, gradually narrowed above to an obtuse or subacute apex ; lateral leaflets similar but with lower margin distinctly gibbous. *Stipules* very small, narrowly deltoid-subulate. Inflorescence lax, slender, sometimes unbranched, but usually with a patent secondary branchlet a short distance below the base of the main rhachis, rarely many-branched. *Calyx-teeth* very unequal, 2 uppermost connate almost to apex, and, like the

2 laterals, broadly deltoid, basal long, subulate. Petals conspicuous, 1–2 cm. long, yellow striped purple. Ovary densely white-pilose ; ripe pods 2–4 cm. long, *sparsely clothed with long silky hairs*, not inflated.

PORTUGUESE EAST AFRICA. Laurenço Marques District : Laurenço Marques, *Mortensen* 14 (C.).

SOUTHERN RHODESIA. Melsetter District : Chirinda outskirts, 1,230–1,300 m. alt., 1906, *Swynnerton* 448 (type of *R. gazensis* Bak. f.).

SOUTH AFRICA. Transvaal. Krugers Dorp Division : Doorn Kop, *Burke* s.n. ; Rustenburg Division : New Rustenburg, 1904, *Nation* 174, and, 1929, *Hutchinson* 2935 ; Potchefstroom Division, 1944, *Loun* 1021. Natal. Weenen Division : Near Weenen, 1891, *Wood* 4470, also, without locality, 1865, *Gerrard* 1902. Cape Province. Many records :—Uitenhage Division : Zwartkops R., *Ecklon* 1666 (type of *R. acuminata* E. & Z.) also 1667 (type of *R. gibba* E. Mey.) ; Enon and Galgebosch, *Drege* s.n. ; Somerset East Division : Bruintjes Hoogte, *Burchell* 2997 and 3096 ; Uitenhage Division, 1847, *Alexander* 117 ; King William's Town Division : Perie, 1894, *O. Kuntze* s.n. and Cathcart Division : Cathcart, 1894, *O. Kuntze* s.n. ; Steynsberg Division : Zuurberg Pass, *Long* 709, etc.

CULTIVATED SPECIMENS. "Bellardi Hort., 1787" in Smith herbarium (Linn.) ; "hort. Madrid 1801" (C.) ; "Jardin des plantes, 1817" in Gay herbarium (K.) ; "jardin de M. Audibert, 1821" in Gay herbarium (K.) ; "hort. Delile, 1831" in Gay herbarium (K.) ; and many other undated specimens. The plant would seem to have been widely cultivated in European botanic gardens in the late eighteenth and early nineteenth centuries.

R. caribaea (Jacq.) DC. var. ***picta*** (E. Mey.) Bak. f. in *Bothalia*, **1**, 125 (1923).

Copisma pictum E. Mey., *Comment. Pl. Afr. Austr.*, 135 (1836).

Rhynchosia gibba E. Mey. var. *picta* (E. Mey.) Benth. ex Harv., *Fl. Cap.*, **2**, 285 (1862).

R. picta (E. Mey.) Burtt-Davy, *Man. Fl. Pl. Transvaal*, pt. **2**, 410 (1932).

Differs from typical *R. caribaea* in its trailing habit, smaller leaflets, *densely pubescent* below ; the inflorescence is often many-branched, and the individual flowers usually a little larger.

PORTUGUESE EAST AFRICA. Laurenço Marques District : Delagoa Bay, 1876, *Monteiro* 14.

SOUTH AFRICA. Transvaal. Barberton Division : Barberton, *Rogers* 23768 (*fide* Burtt-Davy) ; Swaziland. 1910, *Stewart* 4 ; Natal. Dundee Division : Hlatikulu, *Rogers* 23769 (*fide* Burtt-Davy) ; Durban Division : Port Natal, *Drege* s.n. (type of *Copisma pictum* E. Mey.) ; without locality, *Gerrard* 177 ; Inanda Division : Inanda, 1880, *Wood* 692 ; Alexandra Division : Fairfield, 1910, *Rudatis* 896 ; Durban Division : Pinetown, 1932, *Galpin* 12071 ; Orange Free State. Without locality, 1862, *Cooper* 1088. Cape Province. Bathurst Division : Port Alfred, 1813, *Burchell* 4094 ; Somerset Division : *Bowker* s.n. ; Knysna Division : Ruigte valei, *Drege* s.n. ; East London Division : Nahoon R. mouth, 1931, *Galpin* 10636 ; Gonubie R. mouth, 1942, *Acocks* 9148.

Extreme forms of var. *picta* look very distinct from typical *R. caribaea*, but intermediates occur, and, for the present, I am not prepared to give the plant specific rank.

Rhynchosia calvescens Meikle sp. nov. *R. caribaea* (Jacq.) DC. affinis, sed stipulis majoribus, late deltoideis vel ovatis, obtusis vel subacutis, inflorescentiis haud ramosis, leguminibus minute puberulis vel subglabris, valde differt.

[*R. caribaea* (non (Jacq.) DC.) Bak. f. in *Bothalia*, **I**, 125 (1923), pro parte].

Herba perennis sublignosa ; caulis procumbens vel scandens, breviter pubescens ; *stipulae late deltoideae vel ovatae*, obtusae vel subacutae, usque 5 mm. latae et 7 mm. longae, breviter pubescentes, intus valde costatae ; petioli breves, usque 4 cm. longi, pubescentes, parte superiore plani vel leviter canaliculati ; *folia* utrinque sparse pubescentia, subtus glandulis paucis aureis ornata ; foliolum medium deltoideum vel late rhomboideum usque 4 cm. longum et 4 cm. latum in apicem acutum vel obtusum sensim coartatum ; foliola lateralia similia sed marginibus inferioribus con-

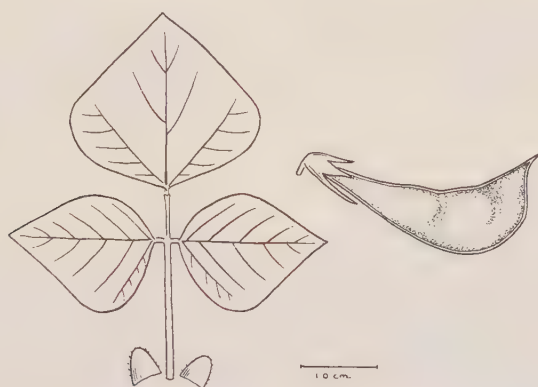


FIG. 2. *Rhynchosia calvescens* Meikle. Leaf, stipules and pod.

spicue gibbosis. *Inflorescentia* usque 12 cm. longa : *haud ramosa* ; pedunculus et rhachis valde pubescens, sparse flavo-glandulosus ; bractae ovatae, acuminatae, usque 4 mm. longae et 2.5 mm. latae. *Flores* mediocres ; calycis tubus usque 5 mm. longus, pubescens, glandulis aureis ornatus, lobi inaequales, 2 superiores deltoideae, connatae, usque 5 mm. longi et basi 4.5 mm. lati, 2 laterales anguste deltoidei usque 5 mm. longi et 1.5 mm. lati, infimus subulatus usque 9 mm. longus et basi 1.5 mm. latus, petala quam calyx multo longiora, vexillum usque 1.4 cm. longum et 8 mm. latum, glabrum vel minute puberulum, flavum, eleganter purpureo vel brunneo-striatum, basin versus breviter auriculatum, macula purpurea ornatum ; alae usque 1 cm. longae et 2 mm. latae, glabrae, aurantiacae, marginibus in appendices brevissimas productae ; carina usque 1.4 cm. longa et 5 mm. lata, glabra, parte inferiori flava, apice purpureo-maculata ; filamenta glabra usque 1.3 cm. longa ; antherae ovoideae, flavae, usque 1 mm. longae et 0.5 mm. latae ; stylus glaber, arcuatus, usque 1.2 cm. longus ; stigma capitatum ; ovarium breviter sericeo-pubescens, glandulosum, usque 5 mm. longum. *Legumen* acinaciforme, *minute et sparse puberulum vel subglabrum*, vix glandu-

losum, usque 3 cm. longum et 8 mm. latum, haud inflatum ; *semina* ovoidea compressa, usque 5 mm. longa et 4 mm. lata, glabra, rufescentia, nigro-marmorata.

SOUTH AFRICA. Natal. Weenen Division : near the junction of the Tugela and Blaauwkraas Rivers, 1896, *Evans* 670. Cape Province. Albany Division : Plutos vale, 1929, *R. A. Dyer* 1838 (typus) ; "in karroid scrub on steep slopes" ; Somerset Division : Commadagga, *Burchell* 3344 ; Somerset? *Bowker* s.n. ; Uitenhage Division : Thickets at Uitenhage, 1847, *herb. Prior* s.n. ; Graaff Reinets Division : Tandjesberg near Graaff Reinets, ca. 1870, *Bolus* 338 ; ? Uitenhage Division : 36th mile from Port Elizabeth to Steytlerville, 1934, *Long* 1198.

Despite obvious affinities with *R. caribaea* (Jacq.) DC., *R. calvescens* seems to have a good claim to specific distinction ; the broad, blunt stipules and the almost glabrous pod are invariably correlated. In addition, the small leaves and unbranched inflorescences give the plant a distinctive look.

Rhynchosia sublobata (Schumach.) Meikle, comb. nov.

Glycine sublobata Schumach., *Beskriv. Guin. Plant.*, 347 (1827).

[*Rhynchosia caribaea* (non (Jacq.) DC.) Guill., Perrott. et Rich., *Fl. Senegamb. Tent.*, 213 (1830-33) ; Hook. f. et Benth. in *Niger Flora*, 313 (1849) ; Bak. in *Oliv. Fl. Trop. Afr.*, **2**, 220 (1871) pro parte ; Hutch. et Dalz., *Fl. W. Trop. Afr.* **1**, 401-402 (1927) ; Bak. f. in *Journ. Bot.* **66**, suppl. 1, 120 (1928) pro parte, and *Legum. Trop. Afr.*, 474 (1929) pro parte].

R. inflata Bojer, *Hort. Maurit.*, 104, (1837), nomen nudum.

R. melanosperma Klotzsch in Peters, *Reise nach Mossambique*, 30 (1861).

[*R. gibba* (non E. Mey.) Bak. in *Oliv., Fl. Trop. Afr.*, **2**, 220 (1871)].

Dolicholus caribaeus Hiern, *Cat. Welw. Afr. Pl.* **1**, 267 (1896).

Rhynchosia macinaca A. Chev., *Expl. de l'Afr. Occ. Franc.*, **1**, 206 (1920) nomen nudum.

Trailing or climbing perennial from a woody rootstock ; mature stems pubescent, young stem (and leaves) *often densely white-sericeous*. Upper surface of mature leaflets sparsely pubescent or subglabrous, lower surface pubescent on nerves and veins, sparsely dotted with minute yellow glands ; mid-leaflet broadly deltoid or rhomboid, rounded or abruptly acute at apex, rarely acuminate, usually with lateral margins markedly gibbous or sublobate ; lateral leaflets similar, with lower margins gibbous ; *stipules very small*, ovate-acuminate or deltoid. Inflorescence lax, *very rarely branched*, rhachis pubescent. Calyx teeth unequal, 2 uppermost connate almost to apex, 2 laterals narrowly triangular, basal subulate. Petals conspicuous, 1.5-2 cm. long, yellow striped brownish-crimson. Ovary shortly velvety-pubescent ; *ripe pods glabrous or thinly puberulous*, 2.5-4 cm. long, *conspicuously inflated*.

SENEGAL. Cayor region, *Heudelot* 401.

GAMBIA. Albréda, *Perrottet* 213.

(SIERRA LEONE. The specimen collected by Afzelius and recorded under *R. caribaea* in *F.T.A.* **2**, 220, and in *F.W.T.A.*, **1**, 402 may belong here ; I have not seen it).



FIG. 3. *Rhynchosia sublobata* (Schumacher.) Meikle. 1. Flowering shoot ($\times \frac{3}{8}$). 2. Calyx ($\times 1\frac{1}{3}$). 3. Standard ($\times 1\frac{1}{3}$). 4. Wing ($\times 1\frac{1}{3}$). 5. Keel ($\times 1\frac{1}{3}$). 6. Gynacium ($\times 1\frac{1}{3}$). 7. Pod ($\times \frac{3}{8}$). 8. Seed ($\times 4$).

FRENCH SUDAN. Macina : Kanikom Cole Plateau, 1910, *Chevalier* 24851.

GOLD COAST. *Thonning* s.n. (type of *Glycine sublobata* Schumach.) (C.) ; Accra District : Accra, 1920, *Dalziel* 9 ; Achimota, 1927, *Irvine* 820.

NIGERIA. Kontagora Division : Kontagora, 1906, *Dalziel* 44, and, 1950, *Meikle* 1033 ; Makurdi Division : Abinsi, 1912, *Dalziel* 612.

UBANGI-SHARI. Yalinga region, *Le Testu* 3714.

BELGIAN CONGO. District du Bas-Congo : Boma, 1931, *Dacre nont* 29 ; District des lacs Édouard et Kivu, Katanda, 1937, *Louis* 7711.

PORTUGUESE MAIOMBE. Chilungo, 1919, *Gossweiler* 5831.

ANGLO-EGYPTIAN SUDAN. Upper Nile Province : Banks of White Nile, lat. 7° 37' N., 1862, *Petherick* s.n. ; Wau District : Gir, 1869, *Schweinfurth* 1870 ; Tsabbi, 1869, *Schweinfurth* 2678.

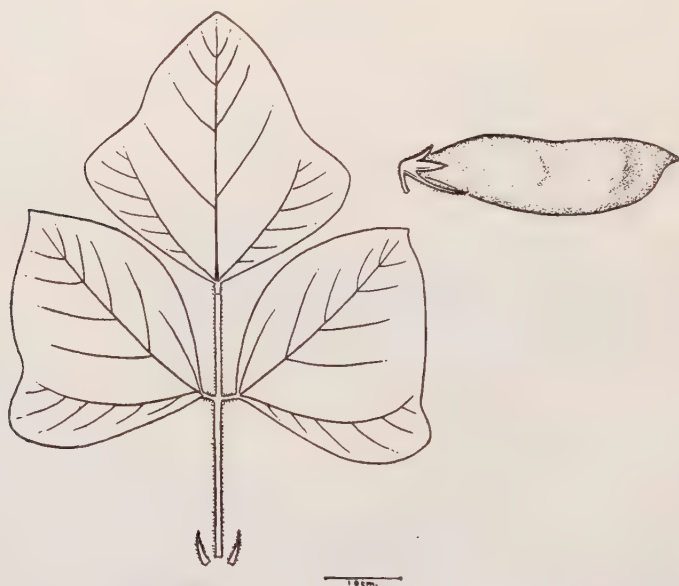


FIG. 4. *Rhynchosia sublobata* (Schumach.) Meikle. Leaf, stipules and pod.

RUANDA URUNDI. Ruzizi Valley, 1907, *Kässner* 3984.

UGANDA. Toro District : Kikorongo, Ruwenzori, 1927, *Maitland* 961 ; Acholi District : Paicho country, Gulu, *Eggeling* 1665 ; Karamoja District : Amaler, Mt. Debasien, *Eggeling* 2539 ; Nakiryanyet, near Mt. Debasien, *Eggeling* 2627 ; Bunyoro District : Mutunda, 1943, *Purseglove* 1322.

KENYA : Tana River District : Tana River, 1910, *Battiscombe* F.D. 268 ; Northern Frontier Province : Mararani, *Graham* F.D. 1561 ; Mombasa District : Mombasa Island, *Bojer* s.n. (type of *R. inflata* Bojer) ; Masai Province : Lenyora, Nguruman Hills, 1944, *Bally* 3845 ; Kitui District : Mutha Plains, 1938, *Bally in Coryndon Museum* 7416.

TANGANYIKA. Tanga District : Amboni, 1893, *Holst* 2810 ; Kilosa

District : Kilosa, 1926, *Burt* 175 ; Tanga District : Tengeni, 1929, *Greenway* 1942, 1964 ; Kilwa District : Kilwa, 1932, *Schlieben* 2397.

PORTUGUESE EAST AFRICA. Sena District : Sena, *Peters* s.n. (type of *R. melanosperma* Klotzsch) ; Laurenço-Marques District : Ressano García, 1897, *Schlechter* 11892 ; Lugela District : Mocuba, Namagoa Estate, 1946, *Faulkner* P.163.

SOUTHERN RHODESIA. Wankie District : Lesuma (Leshumo) valley, *Holub* 704, 716, 825, 833, 843.

BECHUANALAND. Kwebe Hills, 1898, *Lugard* 173.

NORTHERN RHODESIA. Lusaka District : Chilanga, 1909, *Rogers* 8474, 8589 ; Sesheke District, recd. 1911, *Macaulay* 212 ; Mumbwa District : near Mumbwa, 1911, *Macaulay* 676.

ANGOLA : Zenza do Golungo District : By the Calucala R., 1857, *Welwitsch* 4090 ; Loanda District : Boa Vista, 1858, *Welwitsch* 4091 ; also Loanda District, comm. 1905, *Gossweiler* 352 ; Cuanza Norte District : Cassoalala Railway Station, 1921, *Gossweiler* 8308 ; Colete, 193-, *Gossweiler* 9208, 9229.

SOUTH-WEST AFRICA. Amboland : Olukonda, 1885, *Schinz* 799, and same locality, 1894, *Rautanen* 535.

Rhynchosia malacophylla (Spreng.) Bojer, Hort. Maurit., 104 (1837). *Glycine mollis* Hook., Exotic Flora, 3, t. 201 (1827) non Willd., Sp. Pl., 3, 1062 (1803) nom. illeg.

Glycine malacophylla Spreng., Syst. Veg., 4, cur. post., 270 (1827).

Rhynchosia hookeri G. Don, Gen. Syst., 2, 347 (1832).

[*R. caribaea* (non DC.) Bak. in Oliv. Fl. Trop. Afr., 2, 230 (1871) pro parte ; Bak. f., Legum. Trop. Afr., 474 (1929) pro parte].

Trailing or scandent herbaceous perennial ; mature stems clothed with dense, pale indumentum. Leaflets *densely grey-pubescent* above and

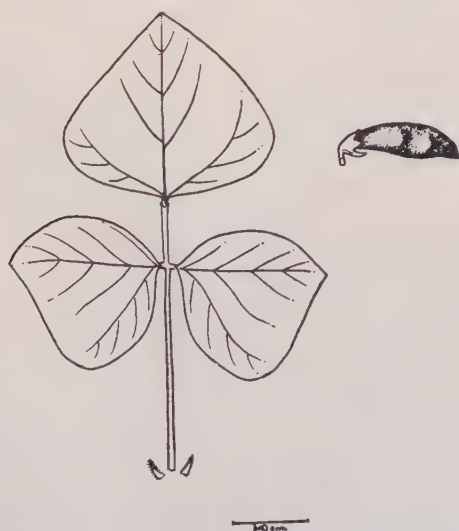


FIG. 5. *Rhynchosia malacophylla* (Spreng.) Bojer. Leaf, stipules and pod.

below, the young leaflets conspicuously soft and velvety: undersurface of leaflets densely covered with small, shining, golden-brown glands. Mid-leaflet broadly deltoid or rhomboid, acute but scarcely acuminate, sometimes with a blunt apex; lateral leaflets similar with rather gibbous lower margins. Stipules minute, narrowly deltoid, pubescent. Inflorescence rather short and dense, unbranched; rhachis softly pubescent. Calyx teeth unequal, two uppermost connate, broadly deltoid, laterals deltoid, basal much longer, narrow-deltoid or subulate. Petals rather small, scarcely 1 cm. long, yellow, not striped. Pod small, 1.5–2 cm. long, minutely pubescent, not inflated.

KENYA. Mombasa District: Mombasa Island, Bojer s.n., Kilifi District: Ribé, comm. 1880, Wakefield s.n.; Lamu District: Witu, comm. 1902, Thomas 153.

CULTIVATED SPECIMENS. Bury Hill gardens, 1825 (type).

A very local species, closely allied to *R. memnonia* (Del.) DC. and perhaps nothing more than a variant of that polymorphic plant. The leaves and flowers are, however, larger than is usual in *R. memnonia*, the inflorescences recalling *R. sennaarensis* Hochst. ex Schweinf. (*R. flavissima* (Hochst. ex Schweinf.) Bak.), though pods and leaves at once distinguish that species.

The old records for *R. malacophylla* from Zanzibar are not to be trusted: Bojer collected the plant at Mombasa and had it in cultivation in Mauritius, whence it was introduced to Bury Hill gardens where Hooker obtained the type material.

A NEW SPECIES OF CAMELLIA.

J. ROBERT SEALY.

Since the publication of a number of new species of *Camellia* in this journal, 1949, p. 215–222, further material of the genus has come to hand which includes two specimens representing a new species. For this I propose the name *Camellia lawii*, in honour of the collector Y. W. Law. A description follows.

Camellia lawii Sealy, sp. nov. affinis *C. punctatae* (Kochs) Coh. Stuart sed pedicello cylindrico ad apicem bracteolis 4 a basi calycis valde appressis enato, calyce cupulari a bracteolis valde distincto, sepalis minoribus haud membranceo-marginatis dense ciliatis differt.

Frutex ramulis gracilibus dense puberulis, ramis cinereis. *Folia* breviter petiolata; *laminae* anguste vel late ellipticae, obtuse acuminatae vel caudatae, plerumque 4–8 cm. longae et 1.7–2.7–(3) cm. latae, coriaceae, obtuse serrulatae dentibus a (1.5)–2–3 mm. separatis, supra saturate virides in costa hirtellae, subtus lucide virides in costa elevata villosae; *petioli* 2–4 mm. longi, dense puberuli. *Flores* breviter pedicellati. *Pedicellus cum calyce* circiter 5 mm. longus; *pedicellus* 1–1.5 mm. longus, cylindricus; *bracteoli* 4, a basi calycis appressi, 0.5–1.5 mm. longi, dense ciliati; *calyx* cupularis, 3–3.5 mm. alta, sepalis rotundatis 2–3 mm. altis dense ciliatis. *Corolla* circiter 1.6 cm. longa, alba; *petala* 5, basi ad tubum staminum usque ad 3 mm. conjuncta, ciliolata, duo

exteriora parte libera obovata 8–10 mm. longa 8–11 mm. lata coriacea, tria interiora parte libera obovata emarginata 9–13 mm. longa 10–13 mm. lata plus minus petalina. *Androecium* circiter 14 mm. longum, glabrum, filamentis exterioribus per 5–6 mm. supra basin in tubum carnosum coalitis. *Gynoecium* circiter 15 mm. longum; ovarium circiter 2 mm. longum, dense albo-pubescent; stylus 13 mm. longus, glaber, trifidus, ramis 4 mm. longis.

CHINA : Szechuan, Pei-pah, *T. W. Law* 303, 335 (typus in Herb. Kew.).

WHAT IS POA HIMALAYANA NEES?

N. L. BOR.

Steudel's description of *Poa himalayana* Nees in Syn. Pl. Glum., 256 (1854) is as follows: "Culmo sarmentoso compresso; vaginis scabriusculis, ligula ovata, obtusa; foliis angustis acuminatis ad paniculam adscendentibus; panicula angusta contracta laxa; radiis subgeminis flexuosis; spiculis 2–3-floris; glumis acuminatis flosculisque patulis lanceolatis; his dorso infero parce sublanatis; valvula inferior 5-nervis, nervis parum prominulis. Nepal".

As is to be found in many other descriptions by early authors, the description above is not sufficiently precise to determine the species. It is mentioned, however, that the sheaths are minutely scabrid, but apart from this, the description might fit a host of other *Poae* and even in the matter of scabrid sheaths, it is not uncommon to find various species whose sheaths could be termed "minutely scabrid".

The next description of *P. himalayana* Nees to be published was that of Hook. f. in Flor. Brit. Ind. 7, 344 (1896). This description is quite full and, moreover, reference is made to two sheets, *Deschampsia*, Wallich Cat. No. 8885* and *Poa* no. 18 Herb. Ind. Or. Hook. f. and T. Thom., upon which the description is based. The description differs from that of Steudel in two important particulars. The sheaths are stated to be smooth not scaberulous and the keels of the palea are stated to be long ciliate.

In the type folder of *P. himalayana* Nees at Kew are three sheets. One is *Deschampsia* No. 8885, Wallich, Nepalia, and two others from Herb. Royle, N.W. Himalaya. The other sheet mentioned, *Poa* no. 18 Herb. Ind. Or., is also to be found at Kew.

A critical examination of these specimens reveals that Wallich's No. 8885 and the *Poa* No. 18 are identical, while those from Herb. Royle are similar to one another but quite different from the former. The differences can be summarised as follows:—

Wallich's No. 8885 and *Poa* No. 18 Hook. f. and T. Thom.

1. Keels of the palea scabrid, not ciliate.
2. Tip of the lower glume reaching halfway up the lowest lemma in the spikelet or less.
3. Creeping rhizome present.

*The plant on this sheet in the Wallichian Herbarium at Kew is a *Poa* not a *Deschampsia*. On the sheet, however, is a reference to another sheet, no. 3802, and this sheet actually contains a *Deschampsia*, namely, *D. caespitosa* Beauv.

4. Found in the Himalayas from Nepal eastwards.
Specimens in Herb. Royle.
1. Keels of the palea ciliate in the lower half.
2. Tip of the lower lemma reaching more than halfway up the lowest lemma in the spikelet.
3. No creeping rhizome.
4. Found in the Himalayas west of Bengal.

This analysis shows that the description published by Hook. f. does not fit the specimens which are quoted as typifying the species *Poa himalayana*. It is, I think, quite obvious that specimens from Herb. Royle were dissected when the description was being drawn up, it being assumed that these specimens were the same species as that collected by Wallich.

As the analysis shows, two distinct species are present, differing morphologically from one another as well as occupying separate geographical regions.

In such a case as this the selection or discovery of the type sheet is an important matter. On the Wallichian sheet from the Herb. Hookerianum in Herb. Kew., Dr. Stapf has pencilled the words "This is evidently the type of *Poa himalayana* Nees". Coming from an authority of the eminence of Dr. Stapf, this might be taken as conclusive, were it not for the fact that Steudel (or Nees in manuscript) does not quote the sheet number.

The type sheet is not in the Berlin Herbarium, nor in the Lindley Herbarium at Cambridge, nor at Paris. The only other way to come to a conclusion is to take the provenance of the plant "Nepal", stated by Steudel, as correct, and by a process of exclusion to find out if Wallich's No. 8885 can, beyond all reasonable doubt, be the type specimen of *Poa himalayana*.

In the preface to his *Synopsis Plantarum Graminearum* (1854-55) Steudel thanks Nees von Esenbeck for the loan of his "*Supplementa Graminearum*", a book in manuscript which apparently was never published. It was certainly in this book that Steudel obtained the name *Poa himalayana* Nees. The date of publication of Steudel's work was 1854, so it is reasonable to conclude that he must have seen Nees' manuscript about 1850, or before, and hence that Nees himself must have seen the plant he named *Poa himalayana* some years before 1850. Very few botanists have collected in Nepal which to this day (1949*) remains closed to Europeans, apart from the area available to Embassy officials. In fact only three botanists visited Nepal prior to 1850, if we exclude a fleeting visit to the north-east frontier of the State by Sir Joseph Hooker in 1848.

Dr. Buchanan-Hamilton visited Nepal in 1802 and made a collection. His plants were determined by D. Don and published in *Prodromus Florae Nepalensis* in 1825. There were no grasses. The next botanist to visit Nepal was that famous collector Dr. Nathaniel Wallich, who spent a year (1820-21) in the capital, Khatmandu. This city is situated

*In this year His Highness the Marajah of Nepal permitted an expedition, which was accompanied by N. Polunin, as botanist, to visit the snow mountains lying to the north of Khatmandu.

in a valley, at an altitude of about 1500 m., surrounded by high hills which in the north are snow-covered. Wallich collected assiduously in the valley of the Capital and, in addition, was able to persuade some of the thousands of pilgrims who annually visit the sacred lakes near Gossainthan, to bring back plants from high altitudes. In this way he was able to get specimens which could not possibly have been collected at the altitude to which his movements were restricted.

The next visitor to Khatmandu was Dr. Hoffmeister, a German, who visited the capital in 1845. Sir Joseph Hooker, writing in *Flora Indica* in 1855, did not know whether he had made a collection of plants or not, and it is fairly safe to say that he did not collect any plants. At any rate, nothing has ever been heard of any.

Taking all this into consideration, it is extremely likely, nay, even probable, that if a grass is cited as coming from Nepal prior to 1850, then that grass was certainly collected by Wallich.

Wallich states in his preface to *Plantae Asiaticae Rariores* that his grasses were to be determined by Robert Brown, though it is certain that Brown did not determine them, and in any event Wallich was referring to the numbered sets which were distributed to various herbaria. Could any Wallichian sheets have come into Nees von Esenbeck's hands? The answer is, yes, and there can be no doubt that Sir William Jackson Hooker was the medium of transfer.

Besides the numbered sheets which went to make up the Wallichian Herbarium, there were a considerable number of duplicate sheets collected by Wallich in Nepal which he gave to Hooker prior to his having numbered them according to the Catalogue. These sheets did not of course bear the Wallichian number, but simply "Nepal, Dr. Wallich 1821", written on the sheet by Hooker himself.

We also know that Hooker and Nees von Esenbeck were firm friends, and that Hooker sent Nees a great many sheets of specimens, particularly grasses, for determination. Nees not only got some of the grass sheets with the Wallichian number, but he also got Wallichian sheets without the number. The proof of this is again to be found in Steudel's *Synopsis*, particularly on page 388, where several new species in *Andropogon* are published from Nees' manuscript. A number of these quote the Wallichian number, but for *Andropogon pendulus* (now *Cymbopogon*), no number is quoted, simply "Nepal".

In *Herb. Kew.* there is a sheet from the *Herbarium Hookerianum* of *Cymbopogon pendulus*, which bears, in Hooker's handwriting, "Nepal. Dr. Wallich. 1821". The sheets in *Herbarium Hookerianum* were sometimes subsequently numbered according to the Catalogue, sometimes they had a strip of the Catalogue with the appropriate number pasted on, or they were even left unnumbered.

A further point which may be made is that there is no other specimen of *Poa himalayana* Nees in the Wallichian Herbarium, and one can only conclude from the evidence which has been detailed above that Wallichian Sheet 8885 is the type number of *Poa himalyana* Nees, and the sheet bearing this number in the Kew Herbarium has consequently been labelled as the type of the species.

That part of the material formerly known as *Poa himalayana* Nees, which agrees with Wallich 8885 will therefore bear the name *Poa himalayana* Nees. The rest of the material which agrees with the specimens in Herb. Royle does not appear to have any name, and in order to regularise the matter, it is proposed to bestow the name *Poa stewartiana* Bor upon it, in honour of Dr. R. R. Stewart, Principal of the Gordon College, Rawalpindi, Pakistan, in recognition of his contributions to the botany of the northwest Himalaya.

As neither of these grasses has been described adequately, a formal description in Latin, followed by a translation in English, and the distribution of the species, is given below for each.

***Poa himalayana* Nees ex Steud., Syn. Pl. Glum. 256 (1854).**

Gramen caespitosum, annuum vel perenne, rhizomate gracili. Culmi glaberrimi, laevissimi, teretes, 0·5–1 mm. diametro infra paniculam, nodis glabri. Foliorum laminae lineares, usque 15 cm. longae, 2 mm. latae, utrimque scabrae, basi rotundatae, pilosae, planae, flaccidae, glabrae; vaginae arctae, persistentes, vetustae saepe laxae, scariosae, a culmis solutae, laeves glabraeque; nodi vaginis haud tecti; ligula brevissima, usque 2 mm. longa, saepe scabra vel puberula.

Panicula laxa usque 16 cm. longa, 8 cm. lata; rhachis glabra laevisque; rami 2-nati, patentes, tenuiter filiformes, flexuosi, scaberrimi, usque 6 cm. longi; ramuli scabri, filiformes. Spiculae anguste oblongae 4·5–6 mm. longae, 3-florae, rarissime 1-florae. Gluma inferior 2·25 mm. longa, explanata 0·5 mm. lata, a latere visa subulata, explanata lanceolato-acuminata, 1-nervis, dorso leviter curvata, dorso carinaque apicem versus scabra, marginibus angustissime hyalina; gluma superior 2·75–3·5 mm. longa, 1 mm. lata, explanata lanceolato- vel anguste ovato-acuta, 3-nervis, carina nervis lateralibus praecipue apicem versus scabra, marginibus anguste hyalina. Lemma 4–4·5 mm. longum, 1·5 mm. latum, 5-nervis, nervis longis, carina inferne longe ciliatum superne scabrum, nervis lateralibus inferne breviter ciliatum, marginibus anguste hyalinum, apice hyalinum vel coriaceum, inter nervos dorso glabrum, scaberulum; lana adest, saepe sat copiosa; rhachilla producta, spiculum vestigiale gerens; articuli usque 1·5 mm. longi; stamina 3; antherae 0·75–1 mm. longae; palea 3 mm. longa, anguste elliptica, carinis dentibus minutis praedita.

Poa himalayana Nees ex Steud., Syn. Pl. Glum. 256 (1854).

A tufted grass, slender when annual, stouter when perennial. The perennial has a slender rhizome. Culms very smooth and glabrous, terete, 0·5–1 mm. in diameter below the panicle. Leaf-blades linear, up to 15 cm. long, 2 mm. wide, scabrid on both surfaces, becoming smooth with age, very scabrid on the margins, often hairy on the rounded base where the blade joins the sheath, flat, flaccid, glabrous; sheaths tightly fitting, when old often loose, scarios, slipping from the culm, smooth and glabrous, not covering the nodes. Ligule very short, up to 2 mm. long, often rough or hairy on the outside.

Inflorescence a panicle, often lax, with widely spreading branches, up to 16 cm. long, 8 cm. broad; rhachis of the panicle glabrous and smooth; branches in twos, up to 3 cm. without branching, scabrid; branchlets

scabrid, sparsely rebranching. *Spikelets* narrowly oblong, 4.5–6 mm. long, 3-flowered, occasionally only 1-flowered. *Lower glume* 2.25–2.5 mm. long, 0.5 mm. wide, awl-shaped in profile, lanceolate-acuminate in shape when flattened, 1-nerved, slightly curved on the back, scabrid on the keel and on the dorsal surface near the tip, very narrowly hyaline on the margins. *Upper glume* 2.75–3.5 mm. long, 1 mm. wide, lanceolate- or narrowly ovate-acute in shape when flattened, 3-nerved, scabrid on the keel and side nerves especially towards the tip, very narrowly hyaline on the margins. *Lemma* 4–4.5 mm. long, 1.5 mm. wide, 5-nerved with nerves reaching nearly to the margin, long ciliate on the lower half of the keel, scabrid above, shortly ciliate in the upper portion of the lateral nerves, very narrowly hyaline along the margins and at the tip or not hyaline at the tip, very glabrous between the lateral nerve and keel, but dorsal surface finely pitted or surface scaberulous. *Wool* present, often fairly copious. *Rhachilla* joints long, up to 1.5 mm. long, continued as a slender stipe up to 2 mm. long, crowned with a rudimentary spikelet. *Anthers* 0.75–1 mm. long. *Palea* 3 mm. long, narrowly elliptic in shape, armed on the keels with very fine antrorse teeth.

IND. OR. Nepal : 1821, *Wallich* 8885 (Typus).

Sikkim : Lachen, 3700 m., 11 Jun. 1949, J. D. Hooker ; Sandhakpu, 2700 m., May 1894, *C. B. Clarke* 35029 ; Di-keeling, 11 May 1876, *C. B. Clarke* 27873 ; Lachung, 4000 m., 20 Aug. 1892, *G. A. Gammie* 950.

Tibet : Yatung, 4000 m., 15 Jun. 1945, *Bor et Kiratram* 20103 ; Chubitang, 4000 m., 22 Jun. 1945, *ibid* 19647.

***Poa stewartiana* Bor, sp. nov., *Poa himalayanae* Nees comparanda, sed ab ea carinis paleae semipilosis inter alia recedit.**

Gramen annum, delicatulum. *Culmi* gracillimi, simplices, laeves glabrique, striatiusculi, nodis glabri. *Foliorum laminae* lineari-acuminatae, virides, flaccidae, basi rotundatae, marginibus minutissime apicem abrupte acutum versus praecipue scabrae, utrimque laeves glabraeque, usque 15 cm. longae, 3–4 mm. latae, superiores vaginis longiores vel breviores ; *vaginae* culmum amplectentes, internodiis longiores, laeves glabraeque, striatae ; *ligulae* membranaceae, truncatae, albescentes, 2.5–3 mm. longae.

Panicula laxa, ovata, usque 20 cm. longa, 10 cm. lata vel latior ; rhachis angulata, capillaris, scaberula vel minutissime scabra vel laevis, striata ; rami 2-nati, erecti, patentes vel demum deflexi, flexuosi, scaberuli, basi nudi, ramulosi, paucas spiculas gerentes. *Spiculae* 3–5 mm. longae, primo late ellipticae, demum cuneatae, 3–4-florae. *Gluma inferior* 2.5–3 mm. longa, explanata 0.75–1 mm. lata, a latere visa subulata, dorso curvata, 1-nervis, laevis, glabra, superne carina scabra ; *gluma superior* 2.5–4 mm. longa, explanata 1–2 mm. lata, oblongo-acuta vel elliptico-oblongo-acuta, 3-nervis, dorso a latere visa inferne recta, superne apicem versus paullo curvata, marginibus hyalina, glabra laevisque, carina superne scabra. *Lemma* 2.5–3.5 mm. longum, explanatum 1.75–2 mm. latum, oblongo-elliptico-acutum, 5-nerve, dorso laeve glabrumque, carina inferne ciliatum, nervis lateralibus glabrum vel ciliatum, marginibus hyalinum, carina superne scaberrimum ; *stamina* 3 ; *antherae* 1 mm. longae, luteae ; *palea* lemmate brevior, valde 2-

carinata, carinis inferne ciliata superne scabra ; rhachilla laevis ; *lana* copiosa.

Poa stewartiana Bor.

A delicate annual grass. *Culms* very slender, smooth and glabrous, somewhat striate, glabrous at the nodes. *Leaf-blades* linear-acuminate, green, flaccid, rounded at the base to the sheath, flat, minutely scabrid on the margins, especially towards the short tip, smooth and glabrous on both surfaces, up to 15 cm. long, 3–4 mm. broad, uppermost leaves as long as or shorter than the subtending sheath ; *sheaths* tight, smooth and glabrous, striate, longer than the internodes ; *ligules* silky, membranous, 2.5–3 mm. long.

Inflorescence a weakly spreading, often nodding, panicle up to 20 cm. long, 10 cm. broad or even larger ; axis angled, capillary, very minutely scabrid or scaberulous or even smooth, striate ; branches in pairs, erect, spreading or finally deflexed, flexuous, scaberulous, bare for 3–4 cm. and then rebranching and carrying a few spikelets at the tips. *Spikelets* 3–5 mm. long, broadly elliptic when young, wedge-shaped when old, 3–4-flowered ; *lower glume* 2.5–3 mm. long, 0.75–1 mm. wide at the widest part, lanceolate-acuminate in shape when flattened, awl-shaped in profile, curved on the back, 1-nerved, smooth and glabrous except on the keel in the upper half which is scabrid ; *upper glume* 2.5–4 mm. long, 1–2 mm. wide, oblong-acute or oblong-elliptic-acute, 3-nerved, straight on the back in profile in the lower two-thirds then gently curving towards the tip, hyaline on the margins, smooth and glabrous, except for the scabrid upper half to the keel. *Lemma* 2.5–3.5 mm. long, 1.75–2 mm. wide, oblong-elliptic-acute, 5-nerved, smooth and glabrous on the dorsal surface, ciliate on the keel in the lower half and on the marginal nerves or the latter glabrescent, hyaline on the margins, coarsely scabrid on the keel in the upper half ; *stamens* 3 ; *anthers* yellow, 1 mm. long ; *palea* shorter than the lemma, strongly 2-keeled, ciliate on the keels in the lower half, scabrid above ; *rhachilla* smooth ; *wool* copious.

IND. OR. N.W. India : Jaunsar, 2000 m., 5 May 1897, *Duthie* 19777, in forest (Type) ; wet rocks on old Mahasu road, 2300 m., 25 Jun. 1878, *J. S. Gamble* 6237A ; Bussahir-Kunawar, 1885 *J. F. Duthie* ; Kashmir, Tragbol, 3200 m., 19 Jul. 1876, *C. B. Clarke* 29244 ; Gulmarg, 3000 m., Jul. 1926, *R. R. Stewart* 8675 ; near Simla, June 1889, *J. F. Duthie* 10137 ; Simla, 27 Aug. 1849, *T. Thomson* ; Punjab, *J. R. Drummond* 21362.

TIMOURIA ROSHEV. AND PSAMMOCHLOA HITCHC.

N. L. BOR.

The discovery that *Timouria aurita* Hitchc. was the same species as *Stipa Hookeri* Stapf* suggested an investigation into *Timouria* a genus of grasses which was created in 1916 by the distinguished Russian botanist, Professor Roshevitz. During this investigation the status of the grass genus *Psammochloa* Hitchc. also came under consideration and this paper presents a critical review of both genera.

*Kew Bulletin, 1950, 319 (1951).

The genus *Timouria* Roshev. was erected by Roshevitz in B. Fedtsch., Fl. Asiat. Ross. **12**, 17 (1916). The following is a free translation of the Latin description of the genus.

"A perennial grass forming clumps. Leaves setaceous-involute. Panicle narrow, dense, spiciform with short branches. Spikelets one-flowered, hermaphrodite, shortly pedicelled, fascicled on the branches. Empty glumes 2, coriaceous, subequal, 3-nerved, acute, scabrid. Lemma shorter than the glumes, elliptic, depressed on the back, 3-nerved, pubescent, 2-lobed at the apex. Awn inserted between the lobes of the lemma, very slender, caducous, erect, not twisted. Palea a little shorter than the lemma, pubescent, 2-nerved. Lodicules 3, truncate. Anthers 3, bare at the apex".

Roshevitz goes on to say that the genus *Timouria* appears to occupy a position intermediate between *Stipa* Linn. and *Oryzopsis* Michx. but is quite different in habit. It differs from *Stipa* by the lemma being elliptic in shape and not narrow and linear and by the very slender awn and from *Oryzopsis* by the lemma being 2-lobed at the apex and bearing an awn between the lobes. One species was described by Roshevitz—namely *T. saposhnikowii*. This species is represented by an excellent figure in B. Fedtsch., Flor. Asiat. Ross., **12**, 174 (1916), t. 12, and there is a figure of the spikelet in Komarov, Flor. U.S.S.R. **2**, t. 5. f. 20 (1934).

Hitchcock published the new genus *Psammochloa* in Journ. Wash. Acad. Sci. **17**, 140 (1927).

The generic features were described as follows "Spikelets 1-flowered, the rhachilla articulating above the glumes, not prolonged behind the palea, glumes about equal; lemma narrow, about as long as the glumes, membranaceous, villous, awned from between two minute blunt lobes, the awn deciduous; palea narrow, villous, as long as the lemma and not enclosed in it; anthers large, minutely pointed, bearing a few short hairs—a stout perennial rhizomatous grass with long narrow compound panicles. The genus differs from *Stipa* in the membranaceous lemma without a strong callus, in the weak deciduous awn and in the equal palea not enclosed. The pilose tipped anthers show a relationship to *Stipa* through the section *Lasiagrostis*. In aspect it resembles *Calamovilfa* but the callus is not bearded."

One species, *Psammochloa mongolica* Hitchc., was described, based on a sheet collected by R. W. Chaney on the Third Asiatic Expedition of the American Museum of Natural History. Another gathering collected on the same expedition is referred to. Both of these sheets are represented at Kew. In the Journ. Wash. Acad. Sci. **18**, 500 (1928) Roshevitz published a short paper pointing out that *Psammochloa mongolica* Hitchc. was really a species of his earlier genus *Timouria*, and he made a new combination viz. *Timouria mongolica* (Hitchc.) Roshev. He remarks in the course of the paper that the "drawing accompanying the description illustrating the analysis of the spikelet of the new grass, at once recalled to me my new genus of *Timouria*. A detailed comparison of the characters of the two genera confirmed my impression that they were the same." This means that Roshevitz formed his opinion on a published description and on a drawing of a spikelet. As will be seen later on, neither the description nor the drawing give an adequate idea of the

structure of the grass. Dr. Hitchcock, himself, in a footnote to this short paper states "Soon after the publication of *Psammochloa* I found the genus *Timouria* described in the Flora of Asiatic Russia, a work which had not been earlier accessible because of the world war. I at once recognised that *Psammochloa* was the same as *Timouria*, but that the Mongolian species was distinct."

Roshevitz also published a paper in Russian on the same subject in the Bull. Jard. Bot. Princ. U.R.S.S. **27**, 353 (1928), but whether it antedates the paper in the Journ. Wash. Acad. Sci., I am unable to say. The former reference is the one quoted in the Index Kewensis. In this paper Roshevitz contrasts, in the form of a table, the characteristics of the two grasses, those of *Timouria* being in Latin, and those of *Psammochloa* in English, but it is worthy of note that the contrasting characters are quoted from published descriptions and are not based on a comparison of the spikelets themselves. Such a method can only be satisfactory if a very accurate description of the two species exists. On the whole Roshevitz's description of *Timouria* is the better as he does mention the nervation of the lemma and palea, and the number of lodicules. Hitchcock's description of *Psammochloa* gives no information on these points, so that the spikelet, because of the deciduous straight awn from between the lobes of the lemma, shows a superficial resemblance to those of *Timouria* and *Stipa*.

This same plant was collected again in Eastern Mongolia by Abbé Licent during his travels of 1922-24 and three of these sheets are at Kew. Dr. Handel-Mazzetti, who worked out this collection discovered that the plant under discussion had been collected in Eastern Mongolia and had been described over a hundred years ago by Trinius in Sp. Gram. **3**, t. 352 (1836) as *Arundo villosa* Trin. There is no doubt at all that this is the same plant for the description is excellent and it is accompanied by a first-class figure.

Handel-Mazzetti first of all considered that the species was an *Ammophila* (which indeed it resembles to a remarkable degree) and made the new combination *Ammophila villosa* (Trin.) Hand-Mazz. in Oesterr. Bot. Zeitschr. **85**, 227 (1936). He states under this reference that the species is a grass "zehn und zwanzig meter kriechend" and that Ledebour, Flor. Ross. **4**, 434 (1852) mentions this plant under the genus *Psamma*, and refers to *Arundo villosa* Trin., but does not make the combination. Handel-Mazzetti subsequently found that his grass was the same as *Timouria mongolica* (Hitch.) Roshev. and he made a further new combination of *Timouria villosa* (Trin.) Hand.-Mazz. in Oesterr. Bot. Zeitsch. **86**, 302 (1937). He ends with the following ominous words "It seems to me to be very doubtful if the species belongs to the same genus as *Timouria Saposhnikowii* Roshev. Trinius describes the species as without an awn and as occasionally possessing two florets. A caducous awn is always (?) present in the young state. The genus obviously does not occupy a position so close to *Stipa* as Hitchcock says since the lemma and the palea are very different. If 2-flowered spikelets are really present the difference will naturally be increased."

A careful comparison of the dissected spikelets of *Timouria* and *Psammochloa* fully confirms Dr. Handel-Mazzetti's doubts. This comparison was made possible through the kindness of Mrs. Agnes Chase, of the

Smithsonian Institution, Washington, U.S.A., who was good enough to let me have two spikelets of the specimen of *Timouria Saposhnikowii* sent by Roshevitz to Hitchcock. It may be said at once that the dissection of these spikelets confirms in every detail the figure given by Roshevitz in Fedtschenko, Flora Asiat. Ross. and in the Flora U.S.S.R.

In order to contrast the parts of the spikelets of *Timouria* and *Psammochloa* their characteristics are placed side by side in the following table.

<i>Timouria</i>	<i>Psammochloa</i>
Glumes 3-nerved.	Both glumes 7-nerved at the base, the side nerves disappearing by anastomosis with the central strong nerve.
Lemma much shorter than the glumes, shortly hairy on the dorsal surface, 2-lobed at the tip, 3-nerved, the two side nerves joining the central nerve just below the fissure and the central nerve above this point very thick ; awn short, caducous, not twisted, issuing from between the 2-lobes at the tip of the lemma.	Lemma as long as the glumes, bifid, long hairy on the dorsal surface, 9-nerved, the nerves joining the central nerve near the tip ; awn short, caducous, not twisted, issuing between the lobes of the shortly 2-lobed tip of the lemma.
Palea as long as the lemma or a little shorter, hyaline, glabrous, 2-nerved, strongly keeled, depressed between the keels, ciliate on the keels.	Palea as long as or longer than the lemma, long hairy on the back, 7-nerved, with the central nerve very faint and the next pair very strong, not keeled but rounded on the back, slightly depressed between the two strong nerves.
Lodicules 3, truncate.	Lodicules 3, elliptic-obovate-obtuse.
Anthers 3, shortly acuminate ; tips glabrous.	Anthers 3, large ; tip bearing a few hairs.

It will thus be seen that the two species differ in almost every essential respect except perhaps, in the caducous, untwisted awn. I have no hesitation therefore in submitting that *Psammochloa* should not be included in the genus *Timouria*, but that it has every right to generic rank on its own account.

I have not been able in a single instance to confirm the whole of Trinius' remark "spiculæ unifloræ (rarius bifloræ)"—this phenomenon must be very rare indeed—nor to agree with his inclusion of the species in the genus *Arundo* or even in *Arundineæ*. At first sight the structure of the spikelet seems to be that above the glumes we have an empty 9-nerved lemma without a palea, followed by a 7-nerved lemma containing a hermaphrodite floret and without a palea. The position of the three lodicules in this upper scale, however, appears to prove that this scale is a true

palea, despite its peculiar nervation. Two of the lodicules are situated touching the lower margins of the scale and the third lies on its concave surface.

If the upper scale is to be considered as a palea it has a structure which, while not unknown in the Gramineae, is sufficiently unusual as to be worthy of note. This palea has a very faint middle nerve, with two strong nerves on either side, and two other faint nerves on each side outside these. The surface of the palea between the two strong nerves is somewhat thinner than the rest of the scale and is slightly depressed.

According to Pilger, *Additamenta Agrostologica*, Bot. Jahrb., **27**, 2, 26 (1948) speaking of the nervation of paleae "es können mehrere Seitennerven in den Seitenflächen ausgebildet werden", and he goes on to mention that one of those in which such a phenomenon has been observed is *Ammophila arenaria*. A middle nerve is not unique in the palea, for *Micraira* F. Muell. is a genus which possesses a 5-7-nerved palea. There are, therefore, no insuperable grounds for believing that the upper scale is anything but a palea.

The similarity in habit between our grass and *Ammophila arenaria* (Linn.) Link is very striking, and the anatomy of the leaves is almost identical, doubtless brought about by the similarity of their habitats. *Psammochloa* inhabits the sand dunes of Eastern Mongolia and spreads widely by means of hard scaly creeping rhizomes (Handel-Mazzetti says 10-20 metres long). If the plant is covered by driven sand the rhizomes extend in all directions and when they reach the surface produce a number of short-noded shoots. From each node a sheath develops and within the axil of the sheath an inflorescence is formed seated on a peduncle. The culm which has developed from the axil of the basal sheath does not itself possess any node and is actually the long peduncle of the inflorescence. This means that there is no time lost in producing flowers and fruit in the short growing season of a desert, such as that of East Mongolia.

As there are many features in the description of this grass which have been overlooked or ignored a full description of the genus and species with the synonymy follows.

***Psammachloa* Hitchcock emend. Bor.**

Panicula longa, erecta, lineari-angusta; axis teres, glaber; spiculae compresso-teretiusculae, hiantes, uniflorae, multae, densae, ramis erectis insidentes; pedicelli clavati, scabri, usque 10 mm. longi; *glumae* lanceolatae, anguste truncatae, obtusae, marginibus hyalinae, 7-nerves, nervis anastomosantibus, inferne dorso rotundatae, superne carinatae; *lemma* explanatum elliptico-lanceolatum, 7-9-nerve, apice breviter 2-lobatum, chartaceum, dorso undique et paene usque ad apicem villis albis patulis vestitum; *palea* lemmati aequilonga, 5-7-nervis, nervo medio tenuissimo, villis albis patulis inferne vestita; *stamina* 3; *antherae* longae, apice sparse villosae; *lodiculae* 3, hyalinae, oblanceolatae, externe pilis longis paucis praeditae.

Gramina arenicola, rhizomatibus late ubique repentibus; *culmi* teretes, glabri, inferne vaginis vetustis stramineis tecti; vaginae totae fissae, laeves, glabrae; *foliorum laminae* convolutae, rarius planae, pallide stramineae.

Species adhuc unica, in Mongolia incola.

Psammochloa villosa (Trin.) Bor, comb. nov.*Arundo villosa* Trin., Gram. Panic. **3**, t. 352 (1836).*Psammochloa mongolica* Hitchc. in Journ. Wash. Acad. Sci. **17**, 140 (1927).*Timouria mongolica* (Hitchc.) Roshev. in Journ. Wash. Acad. Sci. **18**, 502 (1928).*Ammophila villosa* (Trin.) Hand.-Mazz. in Oesterr. Bot. Zeitschr. **85**, 227 (1936).*Timouria villosa* (Trin.) Hand.-Mazz. in Oesterr. Bot. Zeitschr. **86**, 302 (1937).

Gramen perenne, validum. Culmi (pedunculi) 1 m. superantes (fide Hitchcock 1.5 m. alti) inferne usque 2 cm. diametro, laeves glaberrimi, vaginis coriaceis tecti; rhizoma lignosum, ex cuius apice in anno nonnulli culmi cum vaginis et inflorescentiis emergunt, late radicans, aquamosum. Foliorum laminae usque 50 cm. longae, explanatae usque 10 mm. latae, firmae, rarius planae, plerumque convolutae, in apicem validum attenuatae, infra glabrae laevesque, antrorse spinulosae, marginibus ciliatae, supra tomentosae, corrugatae; vaginae omnes ex rhizomatis apice emergentes, laevissimae, glaberrimae, striatae, nitentes, usque inflorescentiam culmum complectentes, vetustis nodis persistentes, demum in fibras dilabentes, lutescentes, brunnescentes; ligulae tenuissimae, juventute membranaceae, vetustae chartaceae, 3–8 mm. longae.

Panicula longe pedunculata, usque 60 cm. longa, usque 4 cm. lata; axis teres, crassus, glaber laevisque vel minutissime scaber vel infra nodos omnes vel omnino tomentosus; rami usque 15 cm. longi, superiores breviores, ascendentes, minutissime sed crasse scabri, ramosi vel haud ramosi, spiculas pedicellis brevibus gerentes. *Spiculae* 10–11 mm. longae, hiantes. *Gluma inferior* 10 mm. longa, 2 mm. lata, truncata vel obtusa, delicatula, marginibus late hyalina, dorso nervis omnino scabra, 5–7-nervis, inferne dorso rotundata, superne carinata, carina scabra. *Gluma superior* 11 mm. longa, 2.75 mm. lata, explanata elliptica vel lanceolata, in apicem obtusum vel truncatum attenuata, 5–7-nervis, dorso omnino scabra, inferne rotundata, superne carinata et carina scabra. *Lemma* 10 mm. longum, 3 mm. latum, explanatum elliptico-lanceolatum, in apicem leviter 2-lobatum attenuatum, glumis aliquantum firmius, 9-nerve, dorso pilis tenuibus 2.5 mm. longis tectum; nervus medianus inter lobos in aristam debilem caducam productus est vel arista abest; arista lemmati aequilonga, haud basi torta, inferne scaberrima; *palea* 9 mm. longa, 2.5 mm. lata, explanata elliptico-lanceolata, apice truncata vel lacerata, 5–7-nervis (nervus medianus obscurus, tum utrinsecus nervus distinctus, alii obscuri) stamina complectens, dorso pilis tenuibus tecta; *stamina* 3; *antherae* 7.5 mm. longae, apice pilos paucos gerentes; *stigmata* plumosa; *lodiculae* 3, oblanceolatae, apice rotundatae, extus pilis paucis longis tectae.

CHINA. Outer Mongolia. Tsagon Nor, 1300 m., *R. W. Chaney* 502; Gatun Bologai, 1200 m.; *R. W. Chaney* 443. East Mongolia, camp in the desert, 27 June 1924 *Licent* 7510; Gobi, Kaog-stein-gol (Yendo sume), 23 June 1924, *Licent* 7490; Ordos Hailiutuhwa towards Sikitan by Borobalgassum, 28 Jul. 1922, *Licent* 6831.

In order to make the story complete it should be mentioned that Nevski in Act. Inst. Bot. Acad. Sci., ser. 1, **4**, 224 (1937), comes to the conclusion that there are no generic differences of any importance between *Timouria* Roshev. and *Achnatherum* P. Beauv. The latter name is an earlier name for the genus *Lasiagrostis* Link, which is kept up as such in the Flora U.S.S.R. but is considered by Hook. fil. in the Flora of British India to be only a section of the genus *Stipa*. At any rate Nevski in the publication noted above, reduces *Timouria* to the synonymy of *Achnatherum* and makes a number of new combinations in his paper. Among them *Timouria Saposhnikowii* Roshev. appears as *Achnatherum Saposhnikowii* (Roshev.) Nevski. So far nobody has made new combinations in *Achnatherum* for *Timouria aurita* Hitchc., *T. mongolica* (Hitchc.) Roshev. or *T. villosa* (Trin.) Hand.-Mazz. and it is hoped that there will be no attempt to do so since neither of the two species represented by these three names is a *Timouria* nor an *Achnatherum*.

A STUDY OF PAPAVER POPULATIONS IN WESTERN THRACE.

H. G. TEDD and W. B. TURRILL.

In May 1937, one of us (H. G. Tedd) made a random sampling of populations of plants of the *Papaver rhoeas* group growing in Western Thrace. This species is well known as a weed of arable and waste land throughout the greater part of Europe but, like many other such weeds, it probably originated in the Mediterranean Region. It is variable genetically and exceedingly plastic according to habitat. The samples collected in Western Thrace total 263 specimens and show variations and character combinations similar to those observed in English populations. The material and further details of analysis of the samples are preserved in the Herbarium at Kew. Here only an outline and general summary of the data, with some discussion of the problems involved, are given. The same classification of characters is used uniformly throughout this paper.

Sample 1. 29 specimens, from near Xanthi, round a well below the golf course, 9.5.37. Plants of lush growth, large in all parts. Stem height mean of 67.9 cm. ranging from 45 to 90 cm. The number of main stems had a mean of 3.1 and ranged from 1 to 10. The division of the lamina was scored into 10 sequential classes (the first most divided, tripinnatifid, and with narrowest segments, the tenth most nearly simple and entire). The following summation indicates the grouping of this sample : 1/1, 2/5, 4/3, 5/4, 6/8, 7/6, 8/2. The hairs on the peduncle were spreading in all specimens. The number of flowers per plant (including flower-buds and fruits) had a mean of 9.9 (from 2 to 43). The colours of the hairs on the sepals were purplish red 8 : golden yellow 9 : white 11. Petal blotch present in 24 : absent in 2 ; border to petal blotch present in 15 : absent in 11. The number of stigmatic rays had a mean of 12.7 (ranging from 10 to 16) and a standard deviation of the mean of 1.59.

Sample 2. 42 specimens, from cornfield at Doumenli, 21.5.37. Plants of lush growth, large in all parts. Stem height with mean of 109.2 cm. and ranging from 75 to 150 cm. The number of main stems had a mean of 1.5 and ranged from 1 to 7. The specimens were scored into the 10

classes for division of the lamina as follows : 1/0, 2/9, 3/1, 4/3, 5/3, 6/7, 7/8, 8/4, 9/5, 10/2. The hairs on the peduncles were spreading for all specimens. The number of flowers per plant had a mean of 7.0 (from 1 to 23). The colours of the hairs on the sepals were purplish red 9 : golden yellow 11 : white 18. Petal blotch present in 19 : absent in 0 ; border to petal blotch present in 7 : absent in 12. The number of stigmatic rays had a mean of 13.0 (ranging from 10 to 15) and a standard deviation of the mean of 1.33.

Sample 3. 15 specimens, from a wheat field near Porto Lagos, 27.5.37. Plants mostly of moderate to lush growth. Stem height with mean of 74.8 cm. (from 44 to 95 cm.). The number of main stems had a mean of 2.9 and ranged from 1 to 8. The leaves are on the whole smaller than those of samples 1 and 2 ; their laminae are pinnate or at most bipinnate ; the specimens were scored for division of the laminae as follows : 2/5, 6/8, 8/1, 9/1. The hairs on the peduncles were spreading for all specimens. The number of flowers per plant had a mean of 11.9 (from 3 to 45). The colours of the hairs on the sepals were purplish red 3 : golden yellow 5 : white 7. Petal blotch present in 5 : absent in 6 ; border to petal blotch present in 0 : absent in 11. The number of stigmatic rays had a mean of 11.3 (ranging from 9 to 13) and a standard deviation of the mean of 1.10.

Sample 4. 51 specimens, from sandy places near the edge of a lagoon and a few near the edge of a cornfield, near Phanar, 23.5.37. Plants mostly slender and, with a few exceptions, of poor and often depauperated growth. Stem height with mean of 29.5 cm. (from 13 to 54 cm.). The number of main stems had a mean of 1.7 and ranged from 1 to 5. The leaves are mostly small, depauperated, with very little cutting but what pinnate lateral divisions there are had to be scored mostly as narrow ; the specimens were scored for divisions of the laminae as follows : 1/5, 2/41, 4/2, 6/1, 8/2. The hairs on the peduncles were spreading 32 : adpressed 17 : intermediate 2. The number of flowers per plant had a mean of 2.5 (from 1 to 9). The colours of the hairs on the sepals were purplish red 6 : white 9. Petal blotch present 0 : absent 31 ; border present 0 : absent 31. The number of stigmatic rays had a mean of 7.8 (ranging from 5 to 11) and a standard deviation of the mean of 1.41.

Sample 5. 26 specimens from lake side by shell dump, Porto Lagos, 27.5.37. Plants mostly slender of rather low growth, but branched from low down. Stem height with mean of 22.6 cm. (from 17 to 29 cm.). The number of main stems had a mean of 2.3 and ranged from 1 to 4. The leaves were mostly moderately small and the cutting was scored as 1/3, 2/13, 1/1, 4/9. The hairs on the peduncle were spreading 16 : adpressed 9 : intermediate 1. The number of flowers per plant had a mean of 3.7 (from 1 to 7). The colours of the hairs on the sepals were purplish red 9 : white 12. Petal blotch present 0 : absent 16 ; border present 0 : absent 16. The number of stigmatic rays had a mean of 10.0 (ranging from 7 to 14) and a standard deviation of the mean of 1.64.

Sample 6. 26 specimens from Xanthie district, Km. 28, 1937. Plants mostly slender and moderately depauperated in appearance. Stem height with a mean of 27.0 cm. (from 16 to 34 cm.). The number of main stems had a mean of 1.5 and ranged from 1 to 4. The leaves are

mostly moderately small and the cutting was scored as 1/2, 2/14, 4/10. The hairs on the peduncle were spreading 14 : adpressed 12. The number of flowers per plant had a mean of 2.8 (from 1 to 7). The colours of the hairs on the sepals were purplish red 3 : white 18. Petal blotch present 0 : absent 13 ; border present 0 : absent 13. The number of stigmatic rays had a mean of 8.9 (ranging from 7 to 11) and a standard deviation of the mean of 1.10.

Sample 7. 71 specimens from eastern end of gravel dump, near lake, Porto Lagos, 27.5.37. Plants moderately slender, mostly branched from near the base. Stem height with a mean of 30.1 cm. (from 19 to 48 cm.). The number of main stems had a mean of 2.5 and ranged from 1 to 9. The leaves are mostly of moderate size and the cutting was scored as 1/7, 2/44, 3/1, 4/13, 5/1, 6/2, 8/2, 9/1. The hairs on the peduncle were spreading 20 : adpressed 47 : intermediate 2. The number of flowers per plant had a mean of 5.2 (from 1 to 19). The colours of the hairs on the sepals were purplish red 2 : white 51. Petal blotch present 13 : absent 33 ; border present 0 : absent 46. The number of stigmatic rays had a mean of 9.7 (ranging from 7 to 14) with standard deviation of the mean of 1.47.

Sample 8. 3 specimens from near Doiranli, in wheatfield, 18.4.37. Plants rather large. Stem height with a mean of 45.3 cm. (from 38 to 53 cm.). The number of main stems had a mean of 2.7 and ranged from 1 to 4. The leaves are of large or rather large size and the cutting was scored as 1/1, 2/1, 3/1. The hairs on the peduncles were spreading 3. The number of flowers per plant had a mean of 4.7 (from 2 to 8). The colours of the hairs on the sepals were purplish red 1 : golden yellow 1 : white 1. Petal blotch present 2 : absent 0 : border present 0 : absent 2. The number of stigmatic rays had a mean of 12.5 (ranging from 11 to 14).

The characters scored for the eight samples, with a total of 263 specimens, are obviously not exhaustive. For example, colour of neither the cell-sap nor of the petals is recorded and the number of specimens with fully mature capsules and seeds was too small for useful quantitative analysis. It should, however, be noted that two main capsule types are present : (a) relatively short and broad in outline, with a ratio of length to breadth of about 3 : 2 ; (b) relatively long and narrow in outline, with a ratio of length to breadth of about 2 : 1. The characters considered fall into two groups : those with a definite genetic basis whose expression as scored is little, if at all, influenced by environmental conditions and those in which the environment acts very markedly to influence the degree of variation. In the first group are the orientation of the hairs on the peduncles, the presence or absence of petal blotch and border, and, probably, the colour of the hairs on the sepals. It is impossible, without breeding experiments, to determine for the second group of characters to what extent the variation is due to different environments or to different genetic constitutions. .

The samples represent populations that can be classified into two groups : samples 1, 2, 3 and 8 can be named *Papaver rhoeas* (apart from No. 6 and possible No. 94, in samples 1 and 2 respectively). Samples 4, 5, 6, and 7 are considered probably to represent populations which have originated from crosses between *P. dubium* and *P. rhoeas*. What the

writers accept as pure *P. dubium* is not represented by samples here analyzed but it occurs in Western Thrace and there are specimens at Kew from this district, as follows : Sakarka, *Tedd* 860 ; near Kozludja, *Tedd* 1288 ; Xanthi-Shahin Rd., Km. 10, *Tedd* 1290 and K. 1318 ; and Kouyouneuy, *Tedd* s.n. and K. 972. In addition to the characters usually considered diagnostic for *P. rhoeas* and *P. dubium* attention may be called to the size of the anthers. Generally the anthers of *P. rhoeas* are 1.25 to 2 mm. in length and those of *P. dubium* 1 to 1.25 mm. in length. There are, however, exceptions, especially in plants of *P. rhoeas* which, when stunted, may have very small anthers.

The quantitative character of number of stigmatic rays is interesting. For comparison with our present figures the following are given :

A. In Journ. Bot. **51**, 48 (1913), E. A. Woodruffe-Peacock records for *P. rhoeas* a range of 9 to 14 with an average of "a trifle under 10" and for *P. dubium* a range of 4 to 7 with an average of 6. **B.** Sir Edward Salisbury has kindly given us the following unpublished figures : *P. rhoeas* range 5 to 18, mean 10 ; *P. dubium* range 3 to 10, mean 6. **C.** From a marrow kale field, near Yarnton, Oxfordshire, 4 July 1945, collected C. E. Hubbard and W. B. Turrill, from 33 different plants of *P. rhoeas*, range 9 to 16, mean 12.2, and standard deviation of the mean 1.74.

As noted below, adpressed or spreading hairs on the peduncle is a character with a genetic basis, the former being dominant over the latter. It is probable, however, that in the Thracian populations samples of which have been analyzed in this paper there are also some modifying factors for several plants occur with the hairs showing an intermediate condition between the fully adpressed and the spreading at right angles. These are scored as "intermediate". There are also probably genes controlling the number and the length of the peduncular hairs (see, for example, plant 46A, with few short hairs).

There have been published several accounts of variation within species of *Papaver*. Some earlier references to genetical studies will be found in the papers by W. C. F. Newton (in Journ. Gen. **21** : 389-404 : 1929) and O. Winge (in Bull. Lab. Gen. Akad. Nauk SSSR, No. 9 : 1932). These two papers are themselves important and both deal with *P. rhoeas*. Newton records that all the varieties he used were self-sterile. His experiments dealt with flower colours, including central blotching. Winge's paper was almost entirely concerned with the hairs on the peduncles. He showed that adpressed hairs (var. *strigosum*) were dominant over spreading hairs but that the latter tended to segregate in a slightly excessive number to 3 : 1 or (in back crosses) 1 : 1 ratios. The adpressed haired plants flowered relatively earlier than the spreading haired plants. Winge concluded that "Probably the fact that the recessive type is the most common in Nature, is explained by its higher vitality".

It is certain that variability in *Papaver rhoeas* and in *P. dubium* is considerable and involves characters that have so far been largely unstudied or unrecorded or, at least, not considered precisely, qualitatively or quantitatively. In particular, the shape of the capsule, the shape of the umbo, the spacing of the stigmatic rays and their width, the crenulations

of the margin of the capsular cap, the number and length of the peduncular hairs, the colour of the sepal hairs and their abundance, and leaf shape require genetical investigation. The attempts to describe and define variation, within the species of *Papaver*, made by taxonomists are by no means satisfactory. Many of the so-called "varieties" or "forms" are merely names given to phenotypic characters with no proper analysis of the genetics concerned or experimental evidence to indicate the range of plasticity. This last is very great for some "characters". The series of specimens of *P. rhoeas* in the Kew Herbarium from the Yarnton district of Oxfordshire includes dwarf flowering plants 3.5 cm. tall with flowers 0.9 cm. in diameter up to tall lush plants 85 cm. tall with flowers 8 cm. in diameter.

The following systematic accounts should be consulted by any student commencing a study of *Papaver rhoeas* and *P. dubium*, but they should be accepted only as a guide to some of the variations to be investigated and not as providing a full and reliable taxonomic basis without further careful consideration: Elkan, Tent. Monogr. Papav., Reg. Boruss., 1839; O. Kuntze, in Acta Hort. Petrop. **10**, 158-62 (1887); Fedde in Pflanzenr. Heft. **40**, IV. 104, pp. 293-301, 308 10, 313-9 (1909); and Mosseray in Bull. Soc. Roy. Bot. Belg. **67**, 80-90 (1934).

MURRILL'S WEST INDIAN SPECIES OF MARASMIUS.

R. W. G. DENNIS.

In North American Flora **9**, pt. 4, (1915) W. A. Murrill described a large number of new species of *Marasmius*, largely from his own collections. The diagnoses were unaccompanied by illustrations and are almost all inadequate for recognition of the fungi by subsequent workers as they virtually ignore microscopic characters. Hence in attempting to identify recent collections from Trinidad and Venezuela the writer has found it necessary to re-examine the types of all Murrill's West Indian species. They were nearly all well collected and have been preserved in good condition at New York Botanic Garden so that it is now possible to figure most of them and to supplement the original diagnoses sufficiently for the species to be recognised again. Fifteen of Murrill's *Marasmius* were recollected in Trinidad and have been fully described and figured in a forthcoming paper in the Transactions of the British Mycological Society. These are *M. marbleae* Murr., and *M. theobromicola* Murr., both referable to *Mycena*, *M. peckii* Murr., *M. subrotula* Murr., *M. atropurpurea* Murr. (= *M. taeteticolor* Berk.), *M. polyporoides* Murr., *M. paucifolius* Murr. (= *M. ferrugineus* Berk.) and *M. graminis* Murr. (= *M. nigripes* (Schwein.) Fr.), all species of *Marasmius* sensu stricto (= *Androsaceus* Pat.), *M. johnstoni* Murr., *M. harrisii* Murr., *M. trojanus* Murr., *M. setulosipes* Murr., *M. cinereialbus* Murr. (= *M. omphalodes* Berk.) and *M. subpruinus* Murr., all of which I would refer to *Collybia*. *M. obsoletus* Murr. appears to be the same species as *M. subpruinus* Murr.

Notes on the remaining species are given below. Colour of the pileus as given by Murrill from the fresh specimen is quoted in brackets, all other observations are original or verified from the type.

Marasmius bahamensis Murrill, North American Flora **9**, 265 (1915). On leaves, Lake Cunningham, New Providence, Bahamas, 8 Sept, 1904, *E. G. Britton* 611.

Pileus (isabelline), surface and gill edge alike covered with yellowish cystides-en-brosse about 7μ diameter. Gills crowded, of two lengths, the longer adnate to the apex of the stipe without a collar, trama stained deep wine-red in Melzer's reagent, no pleurocystidia. Stipe finely downy throughout with hyaline, rather stiff, unicellular hairs, $40-50 \times 6-9\mu$, tapering to a rounded tip. Basidia clavate, $5-6\mu$ diameter. Mature spores not recovered but a few present probably belonging to the fungus measure $4 \times 2\mu$. The whole sporophore has dried ochraceous-buff. It seems to be no more than a pale form of *M. castaneus* Mont., see under *M. jamaicensis* below.



FIG. 1. Type of *Marasmius bahamensis*. Sporophore sketched dry $\times 2$, section of gill edge, pilocystidia and caulocystidia all $\times 660$.

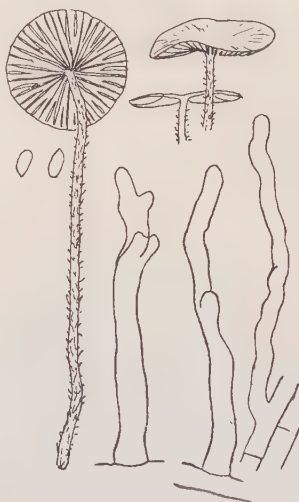


FIG. 2. Type of *Marasmius cervinicolor*. Sporophores and section soaked up $\times 2$, hairs of stipe and spores $\times 660$.

Marasmius cervinicolor Murrill, North American Flora **9**, 265 (1915). On dead leaves, Castleton, Jamaica, 28 Oct. 1902, *F. S. Earle* 223.

Pileus (fawn), surface of woven hyphae. Gills crowded, narrow, adnate, of two lengths, gill edge apparently sterile but not fringed with distinctive hairs. Stipe downy, hairs cylindrical or undulating, some I-septate, obtuse, $4-6\mu$ wide, walls thin, hyaline to yellowish. Spores non-amyloid, narrowly elliptical, $5-6 \times 2.5\mu$. This is probably a synonym of *M. subcoracinus* Berk. & Curt., 1869, described from Cuba.

Marasmius colimensis Murrill, North American Flora **9**, 261 (1915). On debris in Orchard, c. 1600 ft. Colima, Mexico, 3-4 Jan. 1910 *W. A. & E. L. Murrill* 609.

Pileus (pale chestnut) with darker sulcate striae, surface of rather loosely woven hyphae $5-8\mu$ wide. Gills adnate, subdistant, occasionally forked, of two lengths, tramal hyphae slender with clamp connections, walls non-gelatinised, yellowish in Melzer's reagent, rather compact. Stipe minutely downy in the upper part with hyaline, obtuse, thin-walled hairs about $15 \times 5\mu$. Spores subglobose, $5 \times 4\mu$.

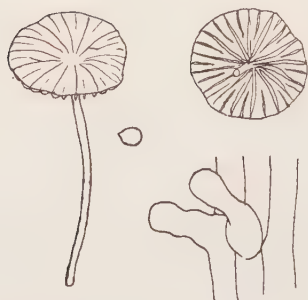


FIG. 3. Type of *Marasmius colimensis*. Sporophore soaked up $\times 1\frac{1}{2}$. Spore and hairs of stipe $\times 660$.

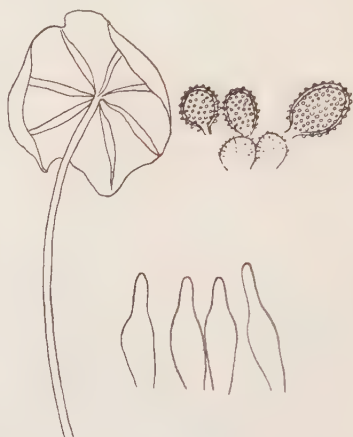


FIG. 4. Type of *Marasmius crescentiae*. Sporophore soaked up $\times 7$, pilocystidia and cheilocystidia $\times 660$.

***Marasmius crescentiae* Murrill**, North American Flora **9**, 259 (1915). On rotting fruits of Calabash, 5 miles E. of Santiago de las Vegas, Cuba, 1 Sept. 1904, *F. S. Earle* 184.

Pileus (ochraceous), surface covered with almost colourless, thin-walled cystides-en-brosse, $6-7\mu$ diameter, interspersed with clavate sphaerocysts up to $13 \times 10\mu$ with thick golden brown walls closely covered with small obtuse warts. Gills about 7, equal, adnate to the apex of the stipe without a collar, gill-edge fringed with colourless, thin-walled, ventricose cystidia about $25-30 \times 6-7\mu$. Stipe blackish-brown, smooth and wiry. Spores not recovered.

This is probably a synonym of *M. sphaerodermus* Speg. var. *major* Speg. 1881 the type of which on *Eryngium agavifolium* is now in the Museum of La Plata. Unfortunately *M. sphaerodermus* itself, an even smaller fungus on *Salix* bark, has apparently not been preserved.

***Marasmius curtipes* Murrill**, North American Flora **9**, 268 (1915). On decaying roots in woods near Moneague, Jamaica, 17-18 Jan. 1909, wet wooded limestone region, *W. A. Murrill* 1128.

The type packet contains two sporophores much damaged by moulds. Pileus (brown), pellicle of very slender hyphae with thick, colourless walls, apparently gelatinised, overlying a trama of loosely woven, non-gelatinised hyphae about 3μ wide. No cystidia or spores recovered.

***Marasmius earlei* Murrill**, North American Flora **9**, 258 (1915). On dead log, Castleton, Jamaica, 28 Oct. 1902, *F. S. Earle* 269.

Pileus (whitish), drying brown, convex, surface of very loosely woven slender hyphae, trama similar, margin straight when moist, incurved when

dry. Gills subdistant, of two lengths, the shorter often fusing with the longer, broad, adnate to the apex of the stipe without a collar, edge apparently sterile but without characteristic cystidia or hairs. Stipe smooth, bay above, blackish below. Spores not recovered.



FIG. 5. Type of *Marasmius curtipes*. Dry sporophores $\times 1$, section of cuticle of pileus $\times 660$.

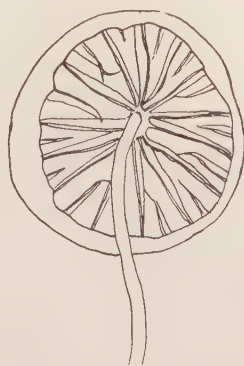


FIG. 6. Type of *Marasmius earlei*. Dry sporophore $\times 14$.

***Marasmius hinnuleiformis* Murrill**, North American Flora **9**, 263 (1915). On cupules of *Quercus* sp. on the ground in moist virgin forest, c. 5000 ft., Jalapa, Mexico, 12–20 Dec. 1909, *W. A. & E. L. Murrill*, 163.

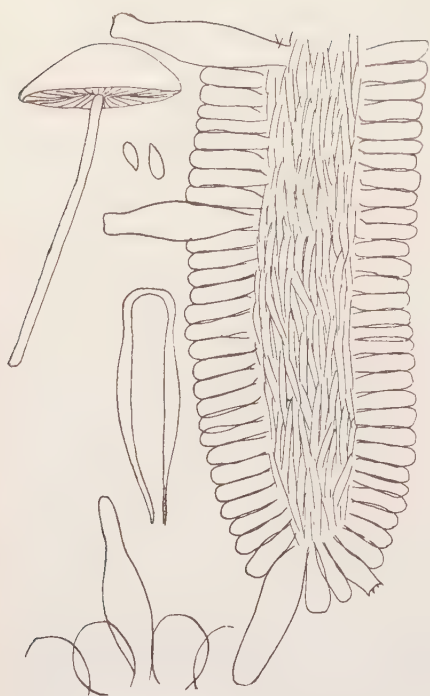
Pileus (whitish, ochraceous on the umbo), smooth when fresh, closely sulcate-striate when dry, epidermis of smooth, subglobose, thin-walled cells, about 15μ diameter, interspersed with ventricose pilocystidia about $30 \times 9\mu$. Trama apparently non-gelatinised. Gills adnate to the apex of the stipe, of two lengths, their faces dotted with colourless, thick-walled, ventricose cystidia $35\text{--}45 \times 8\text{--}12\mu$, often slightly capitate, clearly visible on the dry gills under a $\times 10$ lens, similar cystidia on the gill edge. Stipe concolourous with the pileus, minutely downy with hairs like the cystidia. Basidia 4-spored, $4\text{--}5\mu$ diameter, spores non-amyloid, elliptical, $5\text{--}7 \times 3\mu$.

This is evidently closely allied to *Collybia floccipes* (Fr.) Gill. = *Mycena floccipes* (Fr.) Kühner of Europe and N. America.

***Marasmius hiorami* Murrill**, North American Flora **9**, 256 (1915). On fallen leaves and twigs in forest, San Juan de Porto Rico, Nov. 1912.

Pileus (bay), drying ochraceous-buff, umbilicate with a dark central dot, sulcate-striate to the umbilicus, surface covered with cystides-en-brosse with short processes. Gills 11–12, equal, adnate to a collar round the apex of the stipe. Stipe polished, long and wiry, blackish, sometimes arising from a similar rhizomorph. Spores tear-shaped, non-amyloid, $12 \times 3\mu$. This species apparently differs from *M. guyanensis* Mont. only in the presence of rhizomorphs, a character of doubtful systematic value.

***Marasmius hondurensis* Murrill**, North American Flora, **9**, 258 (1915). On dead sticks, British Honduras, *M. E. Peck* 1906.



Left—FIG. 7. Type of *Marasmius hinnuleiformis*. Fresh sporophore as sketched by Murrill (gills added), $\times 1$, gill section, cuticle of pileus, detached cystidium and spores $\times 660$.

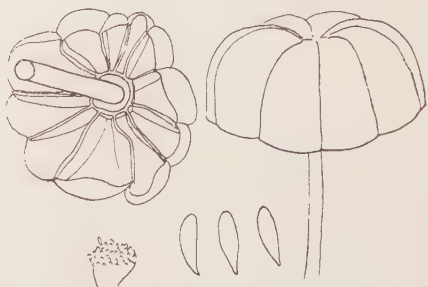


FIG. 8. Type of *Marasmius hiorami*. Soaked up pileus $\times 10$, pilocystidium and spores $\times 660$.

Pileus (white), drying ochraceous-buff, slightly convex with a low obtuse umbo, striate to the disc when soaked up, surface of slender hyphae, trama homogeneous, non-gelatinised. Gills subdistant, adnate to the apex of the stipe, of three lengths, edge fringed with hyaline, undulating cylindrical, obtuse hairs up to $30 \times 5\mu$. Stipe light brown above, shading to almost black below, downy with hairs like those of the gill edge. Spores $7-8 \times 2.5-3\mu$, narrowly elliptical, non-amyloid. The species differs from *M. earlei* in its downy stipe and from *M. dealbatus* Berk. & Curt. in the stipe being dark coloured. *M. rugatus* Mont. appears to be somewhat similar but has a shallow umbilicus, the type at Paris is very mouldy and doubtfully recognisable. Similar, too, is *M. bonaerensis* Speg. 1899, from La Plata, which also has a coloured stipe. Unfortunately here again the type is very mouldy and I could recover no spores from it. *M. hondurensis* would probably be better placed in *Collybia*.

Marasmius jalapensis Murrill, North American Flora **9**, 264 (1915). In leaf mould on the ground in moist virgin forest, c. 5000 ft., near Jalapa, Mexico, 12-20 Dec. 1909, *W. A. & E. L. Murrill* 84.

Pileus (isabelline to fulvous, bay on the umbo), drying ochraceous-tawny, the margin then somewhat sulcate, surface finely reticulately cracked when dry, covered with cystides-en-brosse $7-12\mu$ diameter with brown processes, interspersed with short, brown, thick-walled setae. Flesh whitish. Gills crowded, narrow, adnexed, brown, bristling on sides and edges with stiff, brown, pointed, thick-walled, slightly ventricose setae $70-100 \times 7-10\mu$, rooted in the subhymenium. Stipe cylindrical, zinc-orange above, shading to russet below, clothed with brown pointed



FIG. 9. Type of *Marasmius hondurensis*. Soaked up pileus $\times 4$, portion from below showing gill plan 9, spores and cheilocystidia $\times 660$.

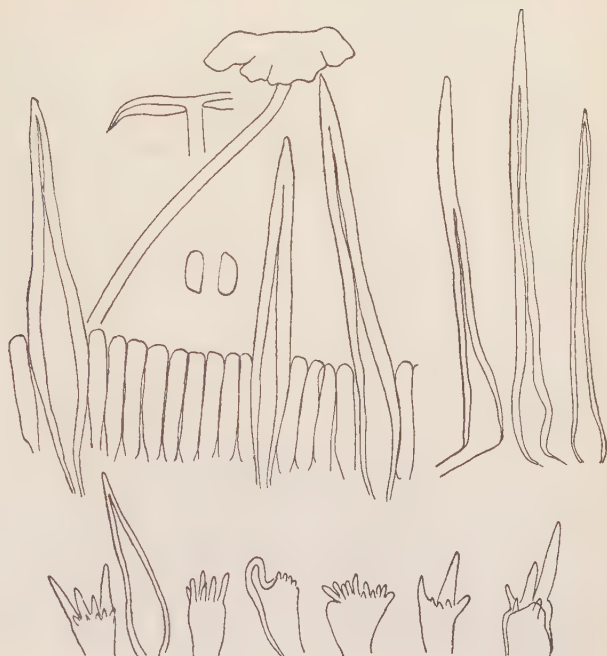


FIG. 10. Type of *Marasmius jalapensis*. Dry sporophore and section $\times 1$, above : section of hymenium, spores and 3 caulocystidia, below : 7 pilocystidia, all $\times 660$.

setae like those of the gills. Trama and contents of the cystidia alike stain deep red-brown in Melzer's reagent. Basidia cylindrical, $3-4\mu$ wide. No spores were found on the gills but adhering to the surface of the stipe and probably belonging to this fungus are elliptic-cylindric, hyaline basidiospores $7-8 \times 3.5\mu$.

***Marasmius jamaicensis* Murrill**, North American Flora **9**, 261 (1915). On fallen leaves, Port Marie, Jamaica, 14 Nov. 1902, *F. S. Earle* 475.

Pileus (bay) orange-brown according to the collector, closely sulcate-striate, surface covered with cystides-en-brosse $7-10\mu$ diameter with rather long golden-brown processes. Gills rather crowded, pallid, margin concolorous with the pileus, adnate to the apex of the stipe, of 2-3 lengths, cheilocystidia like those of the pileus surface. Stipe concolorous with the pileus, downy throughout with stiff, erect, yellowish hairs up to $75 \times 10\mu$. Spores not recovered. This is *M. castaneus* Mont. The type of the latter, from French Guiana in Herb. Montagne at Paris, is mixed with *M. leoninus* Berk. but the application of the name is placed beyond doubt by Montagne's clear diagnosis and by his sketches preserved with the type sheet.

***Marasmius montanus* Murrill**, North American Flora **9**, 266 (1915). On decayed trunk of a tree-fern, Morce's Gap, about 5000 ft., Blue Mountains, Jamaica, 29 Dec.-2 Jan. 1908, *W. A. & E. L. Murrill* 696.

Pileus (bay at the disc shading to rosy isabelline at the margin), surface formed of compactly woven hyphae. Gills rather crowded, adnate to the stipe, of 2-3 lengths, whitish, drying yellow. Flesh thin, whitish, non-gelatinised. Stipe coloured like the pileus, darker below, finely tomentose throughout. No cystidia, spores narrowly elliptical, $5-7 \times 3\mu$. This is evidently a *Collybia*.

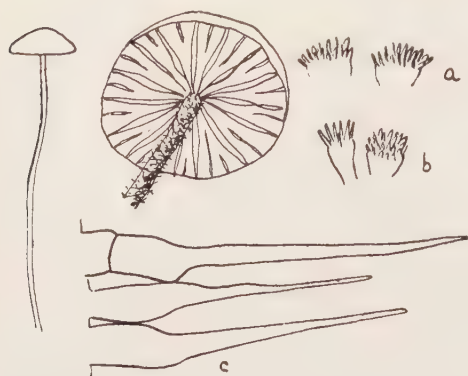


FIG. 11. Type of *Marasmius jamaicensis*. Sporophore $\times 1$, under side of pileus $\times 4$, (a) pilocystidia, (b) cheilocystidia and (c) caulocystidia $\times 660$.



FIG. 12. Type of *Marasmius montanus*. Fresh sporophores as sketched by Murrill $\times 1$, spores $\times 660$.

***Marasmius musicola* Murrill**, North American Flora **9**, 260 (1915). On banana trash, Santiago de las Vegas, 17 June, 1904, *F. S. Earle* 85.

Pileus (pale fawn, disc darker), drying fulvous, flat, slightly sulcate along the gills, covered with cystides-en-brosse up to 10μ diameter with short brown processes. Gills about six, equal, adnate to the apex of the stipe without a collar, narrowed in front and often dying out before reaching the pileus margin, whitish. Stipe hollow, reddish-brown, smooth and shining. Spores tear-shaped, $16-19 \times 3-4\mu$. The species is evidently akin to *M. leoninus* Berk., differing in its smaller size and paler pileus. Similar small pale forms of *M. leoninus* affinity occurred on debris in Trinidad towards the end of November 1949, but these had spores only $8-15 \times 3-4\mu$.

M. graminicola Speg. is structurally similar but very much smaller, only 1-3 mm. across the pileus. Its spores are about $17 \times 5\mu$.

***Marasmius niveicolor* Murrill**, North American Flora **9**, 257 (1915). On dead wood, Motzorongo, near Cordoba, Mexico, 15 Jan. 1910, *W. A. & E. L. Murrill*.

Pileus (snow-white), conico-campanulate, striate, covered with large, finely warted, thinwalled, hyaline, subcylindrical pilocystidia about $30-40 \times 10-15\mu$. Flesh thin, white, non-amyloid. Gills subdistant, of two lengths, arcuate and shortly decurrent, edge fringed with clavate cystides-en-brosse. Stipe completely smooth. Spores non-amyloid, elliptical or slightly tear-shaped, about $8 \times 4\mu$. Basidia about 5μ wide, perhaps two-spored. This fungus is akin to *Mycena osmundicola* Lange, from which it differs in the smooth stipe.

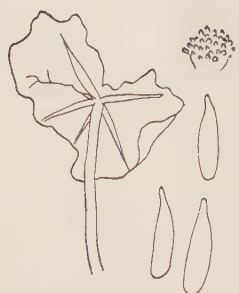


FIG. 13. Type of *Marasmius musicola*. Sporophore $\times 5$, pilocystidia and spores $\times 660$.



FIG. 14. Type of *Marasmius niveicolor*. Murrill's sketch of sporophore $\times 1$, soaked up pileus $\times 4$, (a) cheilocystidium (b) spores (c) basidium and (d) pilocystidia $\times 660$.

***Marasmius pallescens* Murrill**, North American Flora **9**, 261 (1915). On leaves, Rio Piedras, Porto Rico 18 Aug. 1912, *J. R. Johnston* 556.

Pileus (pale red), drying pale pinkish ochraceous, slightly umbilicate with no central black dot, surface covered with cystides-en-brosse about 6μ diameter, bearing rather long processes. Gills 10–11, equal, narrow, adnate to the apex of the stipe without a collar, edge whitish but fringed with cystides-en-brosse, pleurocystidia numerous, refractive, cylindrical, about $40 \times 7\mu$. Stipe 2–2.5 cm. \times 0.5 mm., darkbrown, smooth and polished, surrounded at the base by radiating white hyphae. Spores not recovered. The general aspect of the specimen suggests a pale form of *M. ferrugineus* Berk. 1843.

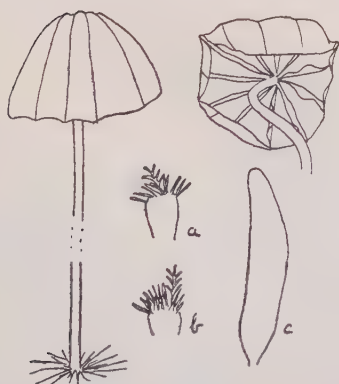


FIG. 15. Type of *Marasmius pallescens*. Sporophore $\times 7$, (a) pilo-, (b) cheilo- and (c) pleuro-cystidia $\times 660$.



FIG. 16. Type of *Marasmius picipes*. Sporophore $\times 7$, part of gill plan $\times 20$, basidia $\times 660$.

Marasmius picipes Murrill, North American Flora **9**, 260 (1915). On fallen leaves of *Eugenia jambos*, 5 miles E. of Santiago de las Vegas, Cuba, II Sept. 1904, *F. S. Earle* 183.

Pileus pale fawn when fresh, tawny olive when dry, minutely floccose-pulverulent, margin faintly sulcate-striate, surface composed of interwoven hyphae about 3μ thick, with brown non-encrusted walls, tramal hyphae similar but colourless, non-gelatinised. Gills subdistant, adnate to the apex of the stipe, of two lengths, white, no cystidia. Stipe tawny above, shading to mummy brown below, smooth, the base finely white-downy. Basidia about $12 \times 4\mu$, 4-spored, spores not recovered. Probably this is a synonym of *M. rugulosus* Berk. & Curt. the type of which was also from Cuba.

Marasmius portoricensis Murrill, North American Flora **9**, 262 (1915). On leaf mould, Rio Piedras, Porto Rico, 6 Sept. 1912, *J. R. Johnston* 570.

Pileus (red, Johnstone ; bay, Murrill), surface covered with cystides-en-brosse. Gills subdistant, slightly adnate to the apex of the stipe, of two lengths, edge covered with cystides-en-brosse $7-8\mu$ diameter mixed with short thinwalled hyaline ventricose cells which also occur in the hymenium. Stipe downy throughout with stiff, erect, light brown, thin-walled hairs about $80 \times 10\mu$, often tapering to a point. Like *M. jamaicensis* this is a probable synonym of *M. castaneus* Mont.

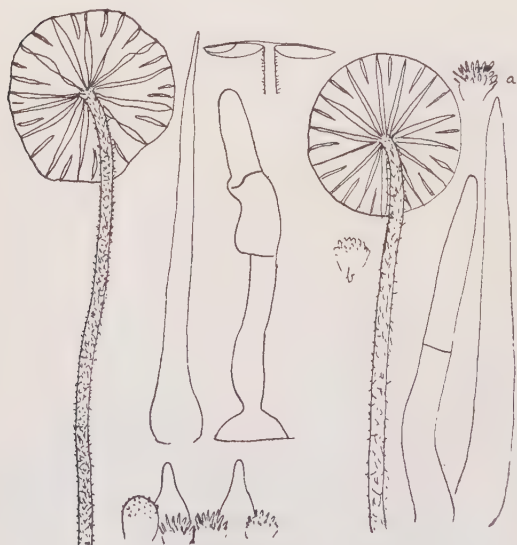


FIG. 17. On left : type of *Marasmius portoricensis*, sporophore $\times 3$, caulo- and cheilocystidia $\times 660$. on right : sporophore from type collection of *Marasmius castaneus* Mont. $\times 3$, (a) pilo-, (b) cheilo- and caulocystidia $\times 660$.



FIG. 18. Type of *Marasmius praedecurrens*. Dry sporophore $\times 5$, spores $\times 660$.

Marasmius praedecurrens Murrill, North American Flora **9**, 257 (1915). On moist ground among mosses and sticks, Bermuda, Nov.-Dec. 1912, *S. Brown*, *N. L. Britton* & *F. J. Seaver* 1383.

Pileus pure white, translucent and striate when soaked up, convex, slightly umbilicate, superficial tissue hard to recover but apparently of broad, thin-walled, short celled hyphae, trama non-gelatinised, not deeply stained in Melzer's reagent. Gills subdistant arcuate, deeply decurrent, without cystidia or marginal hairs. Stipe smooth. Basidia 4-spored, spores non-amyloid, elliptic-cylindric, $7 \times 3\mu$. This is evidently no *Marasmius* but seems closely allied to a collection on fallen leaves in Trinidad which I have described elsewhere as *Mycena micropapillata* Dennis. The latter differs in its persistent papillate umbo, less decurrent gills and in having delicate cylindrical hairs on gill edge and stipe.

Marasmius praetortipes Murrill, North American Flora **9**, 258 (1915). On dead twigs, Hope, Jamaica, 16 Nov. 1902, F. S. Earle 503.

Pileus white, surface formed of loosely woven hyphae with irregular nodulose outgrowths, trama white, of loosely woven, non-gelatinised hyphae $2-3\mu$ diameter. Gills about 14, distant, equal, adnate to the apex of the stipe, edge sterile, fringed with hyaline, nodulose, cylindrical hairs like much elongated cystides-en-brosse. Stipe $2-3$ cm. \times 1 mm., greyish black, densely pruinose-velvety. Basidia 4-spored, spore non-amyloid, elliptical, about $6 \times 3\mu$. Structurally this recalls *M. nigripes* (Schwein.) Fr. but has very different spores and gill edge.

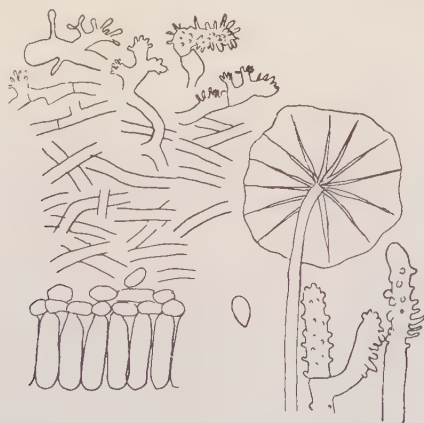


FIG. 19. Type of *Marasmius praetortipes*. Sporophore soaked up $\times 2$, section of pileus, spores and cheilocystidia $\times 660$.

Marasmius pruinosisifolius Murrill, North American Flora **9**, 265 (1915). On soil in woods at Cinchona, 4500–5200 ft., Blue Mountains, Jamaica, 25 Dec.–8 Jan. 1908–09, W. A. & E. L. Murrill 506.

Pileus (isabelline according to the diagnosis but Murrill's coloured sketch preserved with the type is more nearly tawny or russet of Ridgeway), convex, slightly umbilicate, margin incurved when young, surface of rather loosely woven hyphae. Trama of the pileus composed of hyaline hyphae about 4μ wide with thick walls, loosely woven in the upper part, compact above the gills, the whole tissue is much darkened in 10% KOH solution and a brown stain diffuses from it. Gills free, attenuated

at each end, crowded, of about three lengths, very narrow, parallel sided with a broad obtuse edge which is distinctly pruinose under a lens. There are no pleurocystidia, cheilocystidia undulating, cylindrical, obtuse hairs up to about $40 \times 5\mu$. Stipe concolorous with the pileus, hollow, longitudinally furrowed when dried, minutely downy with hyaline, cylindrical, undulating, obtuse hairs about $40 \times 4-5\mu$. Basidia 5μ diameter, 4-spored, spores non-amyloid, as recovered in potash somewhat tear-shaped and about $6 \times 2.5\mu$ but Murrill's sketch, presumably of a fairly fresh spore shows it elliptic-cylindric, slightly allantoid and the size is given as $5-6.5 \times 3-4.5\mu$. This very distinctive fungus should be transferred to *Collybia*.

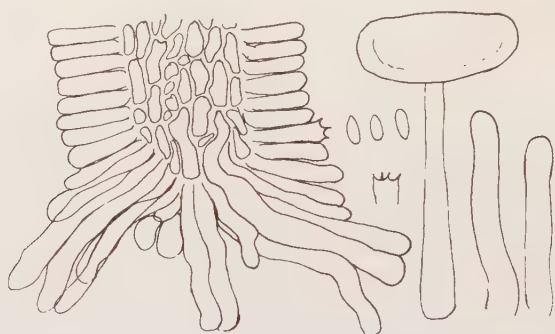


FIG. 20. Type of *Marasmius pruinosi-folius*. Fresh sporophore as sketched by Murrill $\times 1$, section of gill edge, spores and caulocystidia $\times 660$.

***Marasmius pruinosulus* Murrill**, North American Flora **9**, 258 (1915). On dead grass stems, Santiago de las Vegas, Cuba, 16 Oct. 1904, *F. S. Earle* 284.

Pileus white, somewhat translucently striate when moist, surface smooth, of compact hyphae, trama homogeneous, of very loosely woven hyaline hyphae 2μ wide, embedded in a colourless gelatinous matrix. Gills distant, adnate to the apex of the stipe, of two lengths, white, without cystidia. Stipe smooth, white above, black at the base. Basidia about $18 \times 4\mu$, spores not recovered (globose, $3-5\mu$, Murrill). This curious little species superficially resembles *M. paspali* Petch, also on grass stems but differs in its gelatinous trama. It is out of place in *Marasmius* but its correct systematic position depends on the importance to be attached to gelatinisation, about which mycologists are not yet agreed.

***Marasmius soliformis* Murrill**, North American Flora **9**, 261 (1915). On dead leaves, Sir John Peak, 5800-6100 ft., Blue Mountains, Jamaica, 5 Jan. 1909, *W. A. Murrill* 789.

Pileus (dull isabelline with bay disc and conspicuous rays), when soaked up ochraceous buff with ochraceous-tawny striae where the gills show through the subtranslucent flesh, surface smooth, of woven hyphae 3μ wide. Gills subdistant, adnate to the apex of the stipe, of two lengths, edge appearing pruinose under a lens but I was unable to demonstrate distinctive sterile cells. Stipe concolorous with the pileus, covered with a



FIG. 21. Type of *Marasmius pruinosulus*. Sporophores from above and below, soaked up $\times 14$, diagrammatic section of pileus and gills.

fine white down of hyaline, thin-walled, cylindrical, obtuse hairs up to about $40 \times 5\mu$. Basidia 6μ diameter, 4-spored, spores non-amyloid, somewhat tear-shaped, $7-8 \times 3\mu$. This is a *Collybia* and as it came from an almost temperate region it is likely to be identical with some species of the southern United States.



FIG. 22. Type of *Marasmius soliformis*. Sporophore soaked up $\times 1$, caulocystidia, spores and basidium $\times 660$.

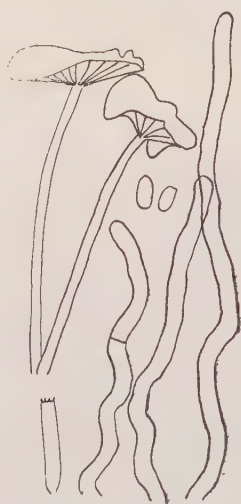


FIG. 23. Type of *Marasmius subcyathiformis*. Fresh specimens as sketched by Murrill $\times 1$, spores, basidium and hairs of the stipe $\times 660$.

***Marasmius subcyathiformis* Murrill**, North American Flora **9**, 269 (1915). On dead fallen sticks in an orchard, Colima, Mexico, 3-4 an. 1910, *W. A. & E. L. Murrill* 615.

Pileus (brownish with a violet tint, near Prout's brown in Murrill's sketch), surface formed of woven hyphae about 4μ wide, trama compact, of similar, non-gelatinised hyphae. Gills moderately spaced, adnate to the apex of the stipe, pallid, without cystidia. Stipe much paler than the pileus, shaggy throughout with hyaline, undulating, thin-walled, septate, somewhat interwoven hairs about 4μ wide. Basidia cylindrical, about

$18 \times 4\mu$, 4-spored, spores elliptical, non-amyloid, $5-7 \times 2-3\mu$. *Marasmius longipes* Mont. is probably this species but as there is already a *Collybia longipes* (Bull. ex Fr.) Quel. Murrill's specific epithet must be retained if the fungus is transferred to *Collybia*, unless another earlier synonym can be found.

Marasmius subplexifolius, Murrill, North American Flora **9**, 263 (1915). Subcaespitose on dead wood, Grenada, 1905, W. E. Broadway.

Pileus white, expanded, centre depressed, pellucidly striate, surface of thinwalled parallel hyphae $4-5\mu$ wide, trama white, of similar non-gelatinised hyphae. Gills subdistant, adnate to the stipe, narrow, of three lengths, closely interconnected by shallow transverse ridges, no pleurocystidia, cheilocystidia clavate, about 5μ diameter with a small number of short simple or forked apical processes. Stipe smooth, hollow, slightly enlarged upwards. Basidia cylindrical, $5-6\mu$ wide with 4 long sterigmata, spores non-amyloid, broadly elliptical, $7-9 \times 4-5\mu$. This fungus belongs to a group of closely related species, referable either to *Collybia* or to the subgenus *Hemimycena* of *Mycena*, which includes *M. semiustus* Berk. & Curt., *M. trojanus* Murr., *M. sabali* Berk. and *M. purpureus* Berk. & Curt. Whether it can be maintained as a distinct species or is to be regarded as a veined form of one of the above must be left undecided until more extensive collecting has made it possible to define their limits of variation.

Marasmius subtenerrimus Murrill, North American Flora **9**, 255 (1915). On dead leaves, British Honduras, M. E. Peck 1906.

Pileus (white), drying pale ochraceous. Somewhat translucent, surface covered with thinwalled, hyaline, pyriform to ventricose cells, trama thin, of loosely woven non-gelatinised hyphae. Gills subdistant, narrow, adnate to the apex of the stipe, often forked and sparingly interveined, bearing thin-walled ventricose cystidia about $20 \times 7\mu$ on both face and edge. Stipe minutely downy with short white hairs. Spores not identified. The whole fungus is very soft and delicate and seems out of place in



FIG. 24. Type of *Marasmius subplexifolius*. Soaked up sporophore $\times 1$, part of gill plan $\times 20$, spores, cheilocystidia and basidium $\times 660$.

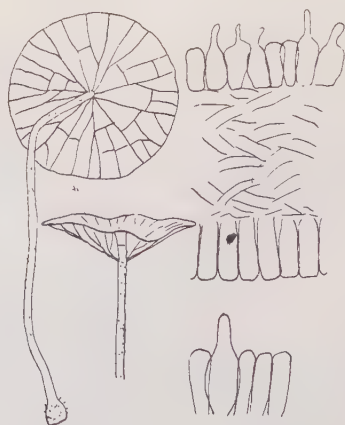


FIG. 25. Type of *Marasmius subtenerrimus*. Sporophore $\times 8$, section of pileus and portion of hymenium with pleurocystidium $\times 660$.

Marasmius but in the absence of the spores discussion of its correct systematic position is not likely to be profitable.

Marasmius sulcatipes *Murrill*, North American Flora **9**, 259 (1915). On dead leaves, Santiago de las Vegas, Cuba, 20 Aug. 1904, *F. S. Earle* 152.

Pileus (fawn according to Earle), expanded, smooth, surface of loosely woven hyphae about 3μ wide, trama rather thick, of similar non-gelatinised hyphae. Gills subdistant, adnate to the apex of the stipe, of two or three lengths, drying deep ochre, narrow and somewhat wedge-shaped in section, no pleurocystidia, gill edge fringed with cylindrical obtuse hairs about $25 \times 3\mu$. Stipe in the dried specimen purplish brown, longitudinally furrowed, probably originally smooth, now covered with mould. Spores non-amyloid, elliptical, $4 \times 2\mu$. I have seen only a single poorly preserved sporophore which could not usefully be figured. The species seems close to *M. subcyathiformis*.

Marasmius underwoodii *Murrill*. North American Flora **9**, 260 (1915). On coconut petioles, base of El Yunque Mountain, Cuba, March 1903, *L. M. Underwood* and *F. S. Earle* 895.

Pileus (pale brownish flesh coloured, disc darker), when soaked up translucent and closely striate, surface of loosely woven hyphae, trama thin, non-gelatinised. Gills crowded, adnate to the apex of the stipe, narrow, parallel sided, without cystidia. Stipe smooth. Spores non-amyloid, elliptical, $6-7 \times 2.5\mu$. This is a species of *Collybia*.



FIG. 26. Type of *Marasmius underwoodii*. Sporophore and section soaked up $\times 1$, spores $\times 660$.



FIG. 27. Type of *Marasmius wilsoni*. Dry sporophore $\times 1$, pilocystidia and pleurocystidia $\times 660$.

Marasmius wilsoni *Murrill*, North American Flora **9**, 261 (1915). On dead leaves, Luquillo mountains, Porto Rico, July 1902, *P. Wilson* 297.

Pileus (light bay) smooth, not striate, surface covered with cystides-en-brosse 7μ diameter with long brown processes. Gills rather crowded, equal, adnate to the stipe, pleurocystidia vesiculose with reddish-brown

contents, cheilocystidia like those of the pileus surface and similarly coloured. Stipe smooth, shiny, apex white, brown below, base surrounded by radiating hyphae. Spores not recovered. *Marasmius ferrugineus* Berk. differs in its striate pileus and darker stipe.

Polymarasmius submulticeps *Murrill*, North American Flora **9**, 286 (1915). On dead wood and humus, British Honduras, *M. E. Peck* 1906.

Pileus (white with dull bay or chestnut umbo), brown throughout when dried, covered with cystides-en-brosse. Gills about 16, adnate to a collar round the apex of the stipe, edge fringed with brown cystides-en-brosse. Stipe smooth, shining, brown at the tip, elsewhere black, arising from a much branched black, wiry rhizomorph. Spores not recovered. This is a synonym, or at most a light coloured form, of *M. trichorhizus* Speg. 1883, which has elliptical spores $7-8 \times 4-5\mu$.



FIG. 28. From left to right : Type of *Polymarasmius submulticeps*, soaked up pileus sketched from below $\times 25$, two sporophores $\times 7$, habit sketch $\times 1$. *Marasmius trichorhizus* Speg. from Pirayu, July 1879, in Herb. Spegazzini, sporophore $\times 7$, habit sketch $\times 1$.

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A SYNOPSIS OF THE GENUS EUONYMUS L.

by R. A. BLAKELOCK.

A need for naming the various species of *Euonymus* arose in connection with research work undertaken at the School of Agriculture, Cambridge, by Dr. Price-Jones and B. D. Wragge Morley on *Aphis fabae* Scop., "Black Fly" or "Sugar-beet Aphis". Several species act as a winter-host to this pest. Mr. Morley put in a considerable amount of work in collecting material, bringing together many of the original descriptions of *Euonymus*, and in generally formulating the problem, as well as calling

the present writer's attention to the fact that no adequate monograph of *Euonymus* exists.

Since some time must elapse before a thorough revision of a large, and in some groups critical, genus can be produced, it is felt that sufficient material is now available to propose a provisional conspectus of the genus *Euonymus*. This is the more the case since previous workers (except Th. Loesener) have only dealt with the species in various more or less restricted geographical areas or with the cultivated species only, and not with the genus as a whole.

PREVIOUS WORK ON THE GENUS.

Of the earlier classifications only the more important need be mentioned here.

Blume (Bijdr. 1146-8 (1825)) gives the following two sections :

Sect. 1. *Fructus subangulatus*. *E. javanicus* Blume, *E. sieboldianus* Blume, *E. japonicus* Thunb.

Sect. 2. *Fructus lobatus* (Tobirae). *E. subtriflorus* Blume, *E. thunbergianus* Blume.

Rafinesque (New Fl. of N. America **3**, 58 (1836)) gives three divisions which are not given any definite rank ; *Platomesus*, *Pentinus* and *Physocondra*. These are distinguished almost entirely on the 4- or 5-merous flowers.

The above two classifications are founded on too narrow a range of material to be of great value, although Blume called attention to the fruit shape.

A greater number of species, twenty-seven in all, were dealt with by M. A. Lawson (in Hook. f. Fl. Brit. Ind. **1**, 607-612 (1875)). He proposed no names of less than generic rank, other than species. His key had the demerit of placing too much emphasis on the length of the style. As some species of *Euonymus* at least have dimorphic flowers, and show long and short styles in the same species, much weight cannot be attached to this character (see Sprague in Kew Bull. 30 (1908)). Sprague mentions *E. europaeus* L., *E. subsessilis* Sprague and *E. microcarpus* Sprague as showing this character ; to which can be added *E. chinensis* Lindl., *E. attenuatus* Wall., *E. gibber* Hance and *E. vagans* Wall.

Maximowicz (in Bull. Acad. Petersb. **27**, 439-454 (1881)) gave an account of the species from Eastern Asia, listing 17 species. His key uses the size of the aril, the depth of lobing of the capsule, and the perennial or deciduous leaves for its major divisions. He made no attempt to name sections or series.

Beck (Fl. von Nied.-Osterr. **2**, abt. 1, 588 (1892)) described two subgenera [Untergattungen] :

1. *Euonymus*. Fls. mostly tetramerous. Filaments distinct or shortened. Another sacs separate. Ovule apotropous on an ascending funiculus. Radicle of seeds therefore directed towards base of the loculus. *E. europaeus*, *E. verrucosus*.

2. *Kalonymus*. Fls. mostly 5-merous. Filaments hump-shaped. Anther sacs confluent on dehiscence. Ovules in pairs pendent from the

apex of the loculus and epitropous. Radicle of the pendent seeds therefore directed towards the apex of the loculus. *E. latifolius* [trans.].

Although Beck only dealt with three species, these subgenera, if the descriptions are somewhat emended, appear to be valid. The nature of the anther sacs can be correlated with that of the winter buds and the capsule.

Pierre (Fl. For. Cochinch. fasc. 20, t. 309 (1894)) divided *Euonymus* into three genera—*Euonymus* L., *Pragmotessera* Pierre, *Pragmatrope* Pierre. The characters mainly used were the 4- or 5-merous flower and ovule characters. Whatever may be the value of such a subdivision, they certainly bring together species not closely related if judged by more conspicuous characters e.g. *Pragmotessera* includes *E. japonicus*, *E. latifolius* and *E. echinatus*. The number of parts in each whorl of the flower is usually constant in a given species. This is not always the case, however, and this character, although useful, should be cautiously used. Later workers have not used Pierre's names as genera.

Rouy and Foucaud (Fl. de France **4**, 158–9 (1897)) recognize two Sections, which are in effect the same as Beck's Untergattungen :

Section I.—*Biloculares* R. et F. "Anthères biloculaires, s'ouvrent en long". *E. europaeus*.

Section II.—*Uniloculares* R. et F. "Anthères uniloculaires, à loges confluent, dehiscences transversalement ou au sommet". *E. latifolius*.

A very valuable account of the Chinese species was given by Loesener (in Engl. Bot. Jahrb. **30**, 448–466 (1902)), in addition to much other work on the genus. He made no attempt to give more than an artificial key, based primarily on the vegetative characters, although he used the capsule characters in the later divisions of his key.

Sprague (in Kew Bull. 29–36, 180 (1908)) gave a key and descriptions of the species with echinate capsules. This forms the basis of the key to Sect. *Echinococcus* in the present paper.

Of those botanists who dealt with the cultivated species, Koch (Hort. Dendrol. 211–212 (1853) and Dendrologie **1**, 625–33 (1869)), Dippel (Handb. Laubholzk. **2**, 485–495 (1891)), Schneider (Ill. Handb. Laubholz. **2**, 170–182 (1912)), Bean (Trees & Shrubs Hardy in the British Isles. ed. 1, **1**, 537–544 (1921) and **3**, 153–157 (1933)), Rehder (Man. of Cult. Trees and Shrubs ed. **1**, 547–553 (1927) and ed. 2, 553–560 (1940)) and Bibliography of Cult. Trees and Shrubs (1949) may be mentioned. Here again the vegetative characters have been much used for the major divisions of the keys. Rehder uses the character of the winter-buds as a secondary division, which separates the two subgenera, although no names to the subdivisions of the genus are given.

Léveillé described a number of species (in Fedde, Rep. Sp. Nov. **13**, 260 (1914)). Some of these were based on imperfect material, and the descriptions of many of them were inadequate. Fortunately the type material of some of these is at Kew. In addition Léveillé's specimens have been examined by Loesener (in Ber. Deutsch. Bot. Gesell. **32**, 538–541 (1914)), and by Rehder (in Journ. Arn. Arb. **14**, 243–9 (1933)). Their views on the affinities of the species have been accepted here.

Loesener's corrections were accepted by Lévêillé in Flore de Kouy-Tcheou (teste Rehder).

In 1936 Wang Chen-Hwa published an account of the Chinese Celastraceae in the Chinese Journal of Botany **1**, 35-68 (1936). This I have not seen.

In 1939 the same author produced a second report on the same subject in Contrib. Botan. Surv. N.W. China **1**, 1-84 (1939). He deals with 61 species of *Euonymus*; five new species are made. A key is provided, which, although owing much to Loesener (1902), gives a more natural grouping of the species. The first division in his key is "leaves alternate or verticillate" as opposed to "leaves opposite". This he uses to separate artificially *E. nanus* M. Bieb from all the other species. The next divisions are based on capsule characters. No names are given to his Sections, Subsections or Series.

A most important modern work on the sub-division of the genus is that of T. Nakai (in Journ. Jap. Bot. **17**, 615-618 (1941)). He deals with only 36 species, mostly Far Eastern. His groups are as follows:

Grex I. *Involuti*—Folia initio ut figura involuta.

Sect. 1. *Pragmotessera* (Pierre) Nakai—Gemmae breves. Folia annua involuta. Flores tetrameri. Fructus exalatus vel alatus. *E. europaeus* L. (typus). *E. bungeanus* Max., *E. dorsicostatus* Nakai, *E. maackii* Max., *E. maackioides* Nakai, *E. nikkoensis* Nakai, *E. sieboldianus* Blume, *E. vidalii* Franch. et Sav. (*E. hians* Koehne), *E. yedoensis* Koehne.

Sect. 2. *Macrogemmum* Nakai—Gemmae elongatae. Folia initio involuta. Flores 4 (-5) meri. Antherae sessiles vel subsessiles. Fructus alatus vel exalatus. *E. macropterus* Rupr. (typus). *E. lanceolatus* Yatabe, *E. melananthus* Franch. et Sav., *E. sachalinensis* Max., *E. yakushimensis* Makino.

Sect. 3. *Vyenomus* (Presl.) Nakai—Gemmae breves. Folia biennia involuta. Pedunculi graciles supra costam foliorum collocati. Flores 5-meri. Antherae sessiles. Fructus exalatus. *E. pendulus* Wall. (typus).

Sect. 4. *Pseudovyenomus* Nakai—Ut *Vyenomus* sed rami verrucosi, folia annua, inflorescentia vulgo 3-flora, flores centrales hermaphroditi laterales masculi, arillus incompletus, testa seminum nigra. *E. pauciflorus* Max. (typus), *E. verrucosus* Scop.

Sect. 5. *Echinococcus* Nakai—Folia annua [an error] initio involuta. Inflorescentia erecta. Flores 4-meri. Filamenta elongata. Fructus echinatus. *E. echinatus* Wall. (typus). *E. acanthoxanthus* Pitard, *E. arboricolus* Hayata, *E. rhodacanthus* Pitard, *E. spraguei* Hayata, *E. trichocarpus* Hayata.

Sect. 6. *Penteuonymus* Nakai—Gemmae elongatae. Folia annua involuta. Flores pentameri. Antherae sessiles. Fructus exalatus vel alatus. *E. oxyphyllus* Miq. (typus). *E. nipponicus* Max., *E. tricarpos* Koidzumi ("sed posterior subsectionem *Tricarpos* format").

Sect. 7. *Melanocarya* (Turcz.) Nakai—Folia annua initio involuta. Flores tetrameri. Filamenta brevia sed exerta. Apocarpa. *E. alatus* (Thunb.) Siebold (typus). *E. kawachianus* Nakai, *E. rotundatus* (Makino) Nakai.

Grex 2. *Equitantes* Nakai—Folia initio ut figuris b, c equitantia.

Sect. 8. *Ilicifolia* Nakai—Folia biennia initio equitantia. Flores pentamenta. Filamenta elongata. Fructus exalatus. *E. japonicus* Thunb. (typus). *E. boninensis* Koidzumi, *E. chibai* Makino, *E. lutchuensis* T. Ito, *E. pseudoradicans* Nakai, *E. radicans* Miq., *E. tashiroi* Max.

Three of Nakai's sectional names are used here ; three more* are reduced to series ; although the descriptions have been emended and changes made in the species the sections contain.

His classification lays considerable emphasis on the veneration of the foliage leaves. Since this calls attention to a previously neglected character, it may be dealt with in a little detail here. It must be objected to Nakai's arrangement that the veneration alone seems rather a minor character on which to base the two major divisions of a genus. The terms used to describe veneration are somewhat confusing. Nakai uses the words involute, obvolute, equitant and imbricate in a different sense to that proposed by Linnaeus (Phil. Bot. 307 (1751)). In the discussion below the Linnean usage has been followed.

In the enumeration above *E. macropterus*, *E. sachalinensis*, *E. oxyphyllus* and *E. oxyphyllus* var. *nipponicus* (*E. nipponicus* Max.), which have an obvolute veneration, are described as having an involute veneration. In *E. alatus* (described by Nakai as involute) the leaves in the bud are imbricate-obvolute, that is imbricate with just the margins overlapping. In the closely related *E. verrucosoides* (not mentioned by Nakai) the outer leaves are imbricate and the inner ones imbricate-obvolute. *E. japonicus* and *E. fortunei* (*E. radicans* Miq.), at least in material cultivated at Kew, have an obvolute veneration. Unfortunately no material of many of the species listed by Nakai is available.

The character is not always so easy to determine from herbarium material as at first appears. For example in *E. myrianthus* the young leaves in the winter bud are imbricate, their margins being slightly incurved but not involute. In spring, however, the young leaves, seen on a living shrub, are markedly involute for a time, flattening out as they mature. If this type of development is at all common conclusions drawn from the dissection of the winter bud only must be very carefully used.

It must however be added that this character probably does possess some taxonomic value if only at the level of series or species. Those species in which a markedly involute veneration has so far been observed, whether in the bud or in the developing leaf, are all in Sect. *Multiovulatus* Loes. (*E. grandiflorus*), or in the related Sect. *Biloculares* as defined below. Examples in the latter Section are *E. europaeus*, *E. verrucosus*, *E. myrianthus*, *E. hamiltonianus* var. *yedoensis*. *E. oresbius*, *E. pauciflorus* and *E. przewalskii* (Sect. *Biloculares*), however, appear to have an obvolute veneration.

The only use made of this character in the present conspectus has been to place *E. melananthus*. The fruits of this species are unknown; its vegetative characters recall those of either *E. alatus* or *E. pauciflorus*. Since its vernation is involute, it has been put with *E. pauciflorus* and its allies in Sect. *Biloculares*.

Two other points on the bud-structure may be conveniently noted here. In the species examined the bud-scales are obvolute, although in a few species the outermost bud-scales are imbricate. In some species (e.g. *E. pendulus*, *E. cochinchinensis*, *E. javanicus*) the margins of the bud-scales are densely lanate.

The nearest approach to a monograph of the genus was produced in 1942 by Loesener (Pflanzenfam. **20B**, 85–107, 115–124). This work did not become available at Kew until very recently. I am indebted to the Department of Botany, Oxford University for the loan of their copy. In the general account of the Celastraceae (l.c., pp. 85–107) Loesener gives much information on literature, anatomy, embryology, pollination, fruit and seed structure, etc. of *Euonymus*. Under *Euonymus* itself (l.c. pp. 115–124) he gives synonymy, a lengthy generic description, notes on the origin and spelling of the name and economic uses. He states that there are 170 species, but only mentions 96 by name. A key in German to the sub-division of the genus is translated here :

- A. Leaves opposite only very seldom spiral if linear, then generally longer than 4 cm., usually however lanceolate or wider, very seldom spiral
- B. Evergreen woody plants with persistent leaves
 - Reihe 1. Scytevonymus* Loes.
- C. Ovules in the loculus 2–4, seldom up to 6
- D. Inflorescences single, more rarely fascicled [gebüschelt], two-or-more-flowered, often dichotomous
- E. Fruit globular or oblong with longitudinal angles or lobed, with the lobes sometimes drawn out laterally compressed forming an apparent wing, not with a tuberculate, spiny or prickly pericarp
- F. Flowers predominantly 4-merous
 - Sekt. 1. Orientales* Loes.
- FF. Flowers predominantly 5-merous
 - Sekt. 2. Malaicae* Loes.
- EE. Fruit prickly or spiny, generally already indicated on the ovary
 - Sekt. 3. Echinatae* Loes.
- EEE. Fruit cornute-winged, as in the *Pterocarpae* (see below).
Leaves sometimes only thinly membranous
 - Sekt. 4. Cornutae* Loes.
- DD. Flowers (or more rarely 2-3-flowered inflorescences) fascicled in the leaf axils often only 1–3 together, seldom 2–3-fl. inflorescences, fascicles sometimes growing into short racemes or panicles
 - Sekt. 5. Glomeratae* Loes.
- CC. Ovules in the loculus 4–12 (leaves sometimes spiral)
 - Sekt. 6. Multiovulatae* Loes.

- BB. Summer-green trees or shrubs with deciduous, thinly membranous, more rarely somewhat thicker leaves
Reihe II. Leptevonymus Loes.
- G. Capsule covered with tubercles or spines ; flowers generally 5-merous
Sekt. 7. Tuberculatae Loes.
- GG. Capsule without tubercular or spiny structures ; flowers 4- or 5-merous
- H. Winter-buds small, only up to 4 mm. long, shortly conical pointed ; capsule lobed, lobes blunt or rounded sometimes (*E. alata* [Thunb.] Rupr.) only one lobe developed ; if a winged fruit see also *E. fimbriata* Wall.
Sekt. 8. Lophocarpae Loes.
- HH. Winter-buds larger, oblong acuminate pointed ; capsules globular or winged
- I. Capsules globular or only ribbed
Sekt. 9. Globosae Loes.
- II. Capsules winged, namely the carinal rib being enlarged into a distinct wing
Sekt. 10. Pterocarpae Loes.
- AA. Leaves small, narrow, linear, entire-margined or very finely serrate or sparsely and indistinctly toothed, obtuse, rarely almost acute, generally distinctly shorter than 4 cm., opposite or more often spiral or in whorls of three (see also AAA)
Reihe III Nanevonymus Loes.
 One *Sekt* only. *Sekt. 11. Nanoides* Loes.
- AAA. Leaves spiral, coriaceous, not linear, or if linear then longer than 4 cm. (see above)
Sekt. 6. Multiovulatae Loes.

It may be pointed out that this subdivision is based firstly and secondarily on vegetative characters. The anther character which largely distinguishes Subgenus *Kalonymus* from the rest of the genus is not used. The capsule characters are considered, however, in the later divisions of the key. This means that although his first two *Reihen* are, at least in my opinion, unnatural groups, many of his *Sektionen* are not unlike the Series used on p. 233-5 below ; although they appear in a very different order. The *Sektionen* may be considered next.

Loesener deals in some detail with each *Sektion*, giving a key to the principal species, but without naming a type species of the *Sektion* or giving a Latin diagnosis or description. As all the names of his subdivisions are here described for the first time it is a little difficult to know how to deal with them. Many of the groups he makes already have names of some rank between that of genus and species ; Loesener nowhere cites Nakai's work of 1941. The others are described here for the first time. Since his descriptions are not in Latin, they can, if necessary, be ignored under the International Rules (Art. 38), but to do so with all of them and to coin new names where needed would only multiply names for no good reason. Where possible Loesener's names have therefore been retained. In some cases Loesener's idea of the limits of a group are

so different from mine that the name is better dropped as confusing ; in others an emendation by the removal of a minority of the species and the inclusion of others seems the most satisfactory course. The *Sektionen* are worth rather more detailed attention and are considered one by one below :

- Sekt. 1. *Orientales* Loes. contains, out of 23 species, ten which appear to me to belong to the same Series as *E. japonicus* Thunb. Of the other species six are in the same Series as *E. myrianthus* Hemsl. The remainder of the species in this *Sektion* seem to me to be in different Sections from either of the two species mentioned.
- Sekt. 2. *Malacae* Loes. contains 13 species, all but one of which, and that a little known species, are in the same Series as *E. myrianthus*. But *E. myrianthus* itself is in the preceding *Sektion*. Admittedly parts of the two Series *Japonici* and *Myrianthi* Blakelock are closely connected, but it may safely be claimed that Loesener's two *Sektionen* are very different in conception from my two series and that the names should not be used. For the two Sections involved older names are available.
- Sekt. 3. *Echinatae* Loes. This includes the evergreen spiny-fruited species, and its nature is perfectly clear. The name is used for a Series below as it is pre-dated for the Section by *Echinococcus* Nakai.
- Sekt. 4. *Cornutae* Loes. Here again the evergreen leaves and the capsule characters form a natural Series and the name is reduced to that rank. As a sectional name it is pre-dated by *Uniloculares* Rouy et Foucaud.
- Sekt. 5. *Glomeratae* Loes. This is a group of species with short few-flowered inflorescences related to *E. javanicus*. The name is retained for a Series with *E. javanicus* as the type. *E. macrocarpus* Gamble and *E. revolutus* Wight included by Loesener, are transferred to another Series on the petal and fruit characters.
- Sekt. 6. *Multiovulatae* Loes. This *Sektion* includes *E. grandiflorus* Wall. and the species most closely related to it. The content of the *Sektion* is clear, although the large disc might afford a better character than the number of ovules. *Multiovulatus* is therefore kept up as a Section.
- Sekt. 7. *Tuberculatae* Loes. is described as the deciduous prickly-fruited species and forms a good Series.
- Sekt. 8. *Lophocarpae* Loes. The first six species of the twelve given are *E. europaeus* L. and its relatives. Of the remaining species two (*E. parviflorus* Hemsl., *E. rothschuhii* Loes.) I have not seen, but they are described as being of the same affinity. Of the remaining four two are *E. alatus* (Thunb.) Siebold and *E. verrucosoides* Loes. These are very closely related to each other and have a more deeply lobed capsule than *E. europaeus*. The other three, included in *Sektion Lophocarpae* are *E. semenovii*, *E. verrucosus* Scop, and *E. przewalskii* Max., are small leaved species, and sufficiently distinct to be placed in a separate Series. It appears to be easiest to exclude the last five men-

tioned species, and then use the name for a Series whose type is *E. europaeus*. The Section already has the name *Biloculares* Rouy et Foucaud.

- Sekt. 9. *Globosae* Loes. contains three species from the two Subgenera and is best abandoned.
- Sekt. 10. *Pterocarpae* Loes. All the deciduous species in Sect. *Uniloculares* are here brought together, although Loesener relies on capsule and not anther characters. There are already two names for this group, Section *Uniloculares* Rouy et Foucaud and Section *Macrogemmi* Nakai. Rouy and Foucaud's name is the earlier and must be used for the Section, which is expanded to include the evergreen species, while Nakai's name may be reduced in rank for the Series.
- Sekt. 11. *Nanoides* Loes. Four species are cited as belonging to this *Sektion*. *E. nanus*, *E. koopmannii* (which I follow Stapf in regarding as conspecific with *E. nanus*) and *E. lichiangensis* seem to be a good Series. *E. nanoides* Loes., which has deciduous opposite leaves, is perhaps best placed in another Series. This raises the difficulty of having a Series *Nanoides* not containing the species *E. nanoides*. Loesener's *Reihe Nanevonymus*, which consists of only *Sektion Nanoides*, is therefore reduced in rank for the Series.

Nakai himself apparently felt his previous classification to be inadequate for, in a paper dealing mainly with the Japanese and Formosan species (in *Act. Phytotax. Geobot.* **13**, 20-32 (1943)), he revised and improved it as outlined below, introducing two new sections, and dividing the genus into six new subgenera.

Subgenus I *Masakia* Nakai

Sect. 1. *Echinococcus* Nakai

Sect. 2. *Ilicifolius* Nakai

Subgenus II *Ortheuonymus* Nakai

Sect. 3. *Pragmotessera* (Pierre) Nakai

Subgenus III *Melanocarya* (Turcz.) Nakai

Sect. 4. *Melanocarya* (Turcz.) Nakai

Subgenus IV *Melanoeuonymus* Nakai

Sect. 5. *Melananthus* Nakai 1943. *E. melananthus* Franch et Sav. (typus), *E. lanceolatus* Yatabe.

Sect. 6. *Paramelananthus* Nakai 1943. *E. yakusimensis* Makino (typus).

Subgenus V. *Vyenomus* (Presl.) Nakai

Sect. *Vyenomus* Nakai

Sect. 7. *Pseudovyenomus* Nakai

Subgenus VI. *Turibana* Nakai

Sect. 8. *Macrogemmum* Nakai

Sect. 9. *Tricarpus* Nakai 1943. *E. tricarpus* Koidz. (typus)

Sect. *Penteuonymus* Nakai

He also removed *E. tanakae* Max. and *E. batakensis* Hayata from *Euonymus* into a separate genus *Genitia* here described for the first time. This step has a certain amount to recommend it, but appears to me rather extreme.

The value of Subgenus IV *Melanoeuonymus* Nakai is more difficult to estimate as only flowering material of one of the three species involved is available. These species have therefore only been provisionally placed.

The chief criticism of Nakai's division is that the subgenera do not appear to be of equal value, so that the distinctness of Subgenus *Kalonymus* Beck (syn. Subgen. *Turibana* Nakai) is not emphasised.

It may be noted that, although the grouping given on pages 232-5 was prepared before Nakai's two papers or Loesener's work of 1942 became available at Kew, it resembles their later rather than their earlier classifications, suggesting that some progress towards a more natural classification of the genus has been made.

The most recent treatment of the genus is by Prokhanov in *Flora USSR* **14**, 548-573, 744 (1949). Here the Subgenus *Kalonymus* is raised to the rank of genus. In the main Prokhanov follows Nakai (1943), although he makes one new section *Kalonymopsis* Prokh. (type *E. verrucosus*) here treated as a synonym of section *Pseudovenomi* Nakai. He also names several new series, but the descriptions are not in Latin and therefore invalid under the International Rules.*

In the present classification Beck's subgenera have been adhered to, since bud, stamen and capsule characters can here be correlated. The Sections are based on the characters of the capsule and only the Series are differentiated on the deciduous or evergreen leaves. This classification bears only a slight geographical correlation, but this criticism would apply to almost any subdivision of the genus.

GEOGRAPHICAL DISTRIBUTION.

The Celastraceae (excluding the Hippocrateaceae) have been described as a family with a cosmopolitan or subcosmopolitan range, a markedly temperate group, its wide actual range being due to the occurrence of a few forms in the Tropics (R. Good, *The Geography of Flowering Plants*, p. 56 (1947)). The same can be said of the genus *Euonymus*.

The greatest number of species are to be found in the Himalaya, China and Japan. The area corresponds fairly accurately with "3. the Sino-Japanese region" as delimited by Good (l.c. p. 117, map, p. 48). There are 118 species in this area, as opposed to four species in Europe, nine species in America and only one in Australia and one, possibly two, in Madagascar and one in N. Africa.

It is difficult to divide the Old World and New World or Temperate and Tropical species into groups on morphological characters. In the Tropics (excluding Formosa) Ser. *Myrianthi* are well represented although a number of these occur on the hills of S. India; Ser. *Glomerati* are confined to the Tropics; Sect. *Ilicifolia* has three species in Tonkin (counting *E. petelotii* Merr., a doubtful member of the Section) and one in Siam; Ser. *Echinati* has three members in the Tropics; Ser. *Fusiformes* are confined here. Forms with fimbriate petals are also confined to the Tropics, and as might be expected no deciduous species are found there (see p.225).

*Since going to press a useful account of the species found in Taiwan (Formosa) by Hou (in *Taiwania* **1**, 182-191 (1950)) has been received. The key is artificial and no new species are made. Also Nakai has raised his subgenera *Masakia* and *Turibana* to generic rank, making many new combinations (in *Jap. Journ. Bot.* **24**, 8-14 (1949); *Biol. Abs.* **25**, 18004 (1951)).

In the table above the numbers indicate the numbers of species in each area. For convenience of representation Upper Burma, Khasia and N. Assam are included in the Himalaya, Tenasserim in Indo-China, Mongolia with Manchuria and Corea, and the Bonin Is. with Formosa and the Liukiu Is.

The discontinuous distribution of *E. nanus* described by Stapf (Bot. Mag. 9308) may be noted here. According to Kleopov and Grin (in Bull. Jard. Bot. Kieff **16**, 103–115 (1933)), who studied the question in Podolia, *E. nanus* is a Tertiary Chinese forest element in the European flora, which migrated to Europe before the Ice Age. At the time of maximum glaciation (Riss-glaciation), it found refuge in the Caucasus and Carpathian mountains. During the ensuing interglacial it spread with the broad-leaved forest of the Pontic plains and extended nearly to the Dnieper. The xerothermic phase at the time of the laying-down of the Upper Loess-horizons compelled *E. nanus* to take refuge in edaphically damp woods along the river valleys. This divided its area of distribution in the Pontic region into single more or less isolated localities. At present it is passing through a retrogressive stage, at least in this region, since it has degenerated and lost the capacity to fruit.

PALAEONTOLOGY.

The palaeontology of the Celastraceae is discussed by McNair in Bull. Univ. Kansas, Sci. Bull. **19** (11), 221 (1930).

“Just where and when the family originated is uncertain according to the available papers on this subject, but it is thought probable that it had its origin in Europe and was distributed in Europe and N. America during the Cretaceous periods. During the Tertiary times the family, and especially the genera *Euonymus* and *Celastrus*, is thought to have been distributed not only in Europe and N. America, but as far as Greenland, Spitzbergen, Alaska, Australia and Java. The palaeontological findings have been mostly leaves. The present day distribution of the Celastraceae, and in particular of *Euonymus* and *Celastrus*, lends support to the belief that the Celastraceae were to be found in both Europe and N. America during Tertiary times. Of the species of *Euonymus* living today, *E. europaeus* and *E. latifolius* are known in the Quaternary strata from Europe”.

Other works mentioning fossil *Euonymi* are :

- Berry, E. W. ; “The Middle and Upper Eocene floras of south eastern America” in U.S. Geol. Survey Prof. Paper **92** (1924).
- Berry, E. W. ; “Revision of the lower Eocene Wilcox flora of the south eastern States with descriptions of new species, chiefly from Tennessee and Kentucky” in l.c. 156 (1930).
- Berry, E. W. ; “A revision of the flora of the Latah formation” in U.S. Geol. Surv. Prof. Paper 154, 225–265 (1929).
- Ball, O. M. ; “A contribution to the paleobotany of the Eocene of Texas” in Bull. Agric. and Mechanical Coll. Texas, Prof. Paper (4th Ser.) **2**, 1–173 (1931).
- Hu, H. H. and R. W. Chaney ; “A Miocene flora from Shantung Province, China” in Palaeontol. Sinica N.S.A. **1**, 1–141 (1940). [Biol. Abstracts **16**, 16821].
- Loesener, Th. ; Pflanzenfam. **20B**, 104 (1942).

- MacGintie, H. D. ; " The Trout Creek flora of south eastern Oregon " in Carnegie Inst. Washington Publ. **416**, 21-68 (1933).
 Schimper, W. P. and A. Schenk ; Handbuch der Palaeontologie, 577-589 (1890).

ANATOMY.

The anatomy of several species is described by G. T. McNair, " Comparative Anatomy within the genus *Euonymus* " in Bull. Univ. Kansas, Sci. Bull. **19** (11), 221-260 (1930). Reference should be made to this paper for the details. It may, however, be noted here that eight species and one variety are examined ; perhaps too few to draw any correlation between the anatomical characters, and the Series and Sections here proposed.

The eight species dealt with are *E. atropurpureus*, *E. europaeus*, *E. bungeanus*, *E. maackii* (all in Ser. *Europaei*, Sect. *Biloculares*), *E. alatus* (Ser. *Alati*, Sect. *Melanocarya*), *E. americanus* (Ser. *Americani*, Sect. *Echinococcus*), *E. kiautschovicus* (*E. patens*), *E. fortunei* (*E. radicans*) (Ser. *Japonici*, Sect. *Ilicifolia*), and " *E. europaeus nanus* Lodd." The material of " *E. europaeus nanus* " was never seen by McNair in flower or fruit and its anatomy appears to differ from that of *E. europaeus* more than one would expect in a variety. I therefore suspect that it has been misidentified. The other species appear in McNair's keys in the sequence given above thus keeping all the species in one Series together. *E. americanus* appears to show more in common with *E. fortunei* and *E. kiautschovicus* than with the other species. This bears out the relationships suggested on morphological grounds (p. 224).

Other works dealing with the anatomy of the genus are listed here : Hegi, G. ; Illustrierte Flora von Mittel-Europa, **5**, I, 246-256 (1925).

Holm, T. ; in Bot. Centralbl. **111**, 492-3 (1909). [includes a short note on the anatomy of *E. americanus* and *E. atropurpureus*.]

Loesener, Th. ; Pflanzenfamilien **20B**, 91-96 (1942).

Moll, J. W. and H. H. Janssonius ; " Mikrographie des Holzes der auf Java vorkommend en Baumarten " **2**, 265-271 (1908). [*E. javanicus*. Good bibliography dealing with other species].

Nyström, F. et J. Berdodu ; " Nouvelles observations sur les chloroplastides de la moelle d'*E. japonicus* and d'*Aucuba japonica* " in Bull. Soc. Bot. France **95**, 272-5 (1948).

Rehder, L. ; " Les Stomates des Celastracees " in Bull. Soc. Bot. Genève ser. 2, **6**, 13-18 (1914). [The stomata of *E. verrucosus*, *E. europaeus*, *E. hamiltonianus*, *E. latifolius*, " *E. macropterus* var. *maackii* ", *E. japonicus*, and " *E. japonicus* var. *radicans* " are described].

Stahl, E. ; " Entwicklungsgeschichte und Anatomie der Lenticellen " in Bot. Zeitung **31**, 616 (1873). [*Euonymus* sp., *E. verrucosus*].

Reference may also be made to Solereder (Systematic Anatomy of the Dicotyledons 1908) and Metcalfe and Chalk (Anatomy of the Dicotyledons **1**, 382, 392, 397 (1950)).

PHYLOGENY WITHIN THE GENUS.

It is premature to draw up any elaborate account of the relationships of the species. The following remarks are to be taken as mainly speculative.

Since the conspectus and keys lay most emphasis on the differences between the groups it may be as well to trace their similarities and relationships. Those species which appear to connect two Series are commented on in the enumeration.

The anthers of the Subgenus *Kalonymus* are one of the most remarkable structures found in the genus. They are certainly highly specialized whether compared with that usual in flowering plants or with the rest of *Euonymus*. Possibly they may be regarded as an adaptation to some short-tongued insect-visitor. The shape of the capsule (especially in the species with unwinged capsules), and to a lesser extent other characters, relate the Subgenus *Kalonymus* more closely to Sect. *Ilicifolia* than to any other group.

Sect. *Echinococci* also seems to be differentiated from Sect. *Ilicifolia* mainly by excrescences on the capsule.

Sect. *Stenocarpus* appears somewhat aberrant and is little known, the fimbriate petals of *E. recurvans* possibly connect it with Ser. *Myrianthi*.

The rest of the genus show a more complex and reticulate relationship. Sect. *Multiovulatus* shows two affinities ; one with Ser. *Nanevonymus* in the alternate leaves ; the other with Ser. *Myrianthi* in the capsule and leaf shape. I am uncertain how much value should be placed on the large number of ovules in *E. grandiflorus* ; it should be noted that *E. myrianthus* has 4 (rarely 6) ovules in each loculus. This section might occupy an intermediate place between Ser. *Nanevonymi* and *Myrianthi*, but the large disc gives it a character of its own.

Ser. *Nanevonymi* appears somewhat distinct from the rest of Sect. *Biloculares* in the verticillate or alternate leaves ; but their small leaves and often low-growing habit connect them with Ser. *Pseudovynomi*. *E. lichianensis* might be placed in either Series.

Ser. *Glomerati* are separated somewhat artificially from Ser. *Myrianthi* by generally shorter peduncles and fimbriate petals, and are clearly very close to some members of Ser. *Myrianthi*. Ser. *Myrianthi* is a large and rather varied group, with affinities with most other Series in the Subgenus *Euonymus*. This suggests that several other Series have been derived from Ser. *Myrianthi*.

The deciduous leaves are the most important character which separates Ser. *Lophocarpi* from Ser. *Myrianthi*.

Section *Melanocarya* are marked by the deeply lobed capsule, which, however, is nearer to some of Ser. *Myrianthi* than to that of Sect. *Ilicifolia*. There is some resemblance in general appearance between some members of Sect. *Melanocarya* and Ser. *Pseudovynomi* (e.g. *E. alatus* and *E. verrucosus*). Corky wings, as on the stems of *E. alatus*, are also found in *E. phellomanus* (Ser. *Lophocarpi*).

The following assumptions might be supported on general grounds in any group of Dicotyledons :

1. A round smooth capsule is more likely to be primitive than one deeply lobed or with outgrowths.
2. A stamen with a filament and two thecae is more likely to be primitive than a sessile stamen with one theca.

3. Entire petals are more primitive than fimbriate ones.
4. The evergreen habit is more primitive than the deciduous one.

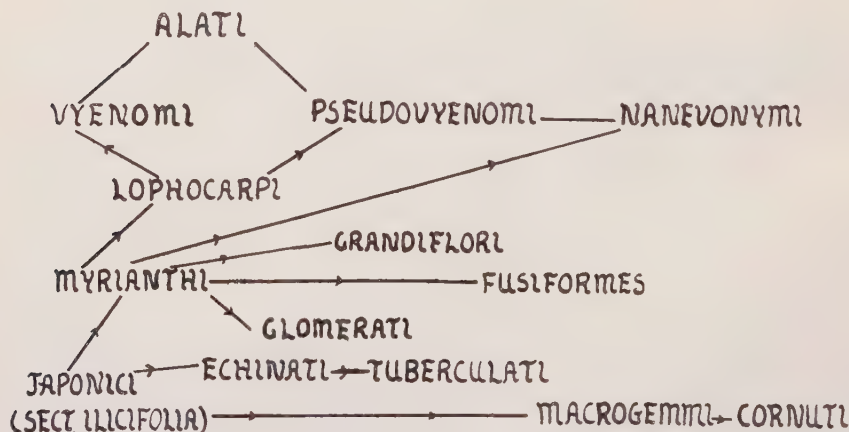
This rather takes for granted the Foliar Origin of the Carpel and the primitive nature of the Magnoliaceous or Ranalian flower. If Corner's Durian Theory (Ann. Bot. **13**, 367-414 (1949)) is accepted the spiny capsules of Sect. *Echinococcus* should mark it as the most primitive section, but the rest of Corner's views are of too wide a nature to elucidate the phylogeny within the narrow confines of a single genus.

If these four points are granted (and ignoring for the moment the possibility of reduction), then Sect. *Ilicifolia* clearly forms the most primitive group. The other groups may be divided into those related directly to it, and those indirectly related through the more primitive members of Ser. *Myrianthi*.

The other characters involved such as disc size, tetra- or pentamerous flowers, leaves verticillate, alternate or opposite, vernation involute or obvolute, buds large or small are more difficult to interpret in evolutionary terms, except that, as a conclusion from what has been said above, characters not found in Sect. *Ilicifolia* are probably derivative rather than primitive, at least in *Euonymus*.

The deciduous habit is here regarded as having arisen several times in the genus in species not otherwise closely connected.

The relationships of the Series may be tentatively arranged thus :



The above only deals with the morphological characters of the genus. It is as well to discuss how far this classification can be correlated with the geographical distribution.

The statement has often been made that the area, in which a genus has the greatest number of species and where the species are the most diverse, is the original home of the genus. In the present case this is the Sino-Japanese region (p. 219). It may be noted that the rest of the Celastraceae are well represented there. The Sect. *Ilicifolia* has most of its members (16 species) in this area, and only two species in Tonkin, one in Siam, and one in Mexico. That Ser. *Myrianthi* and *Lophocarpi* (both in

Sect. *Biloculares*) are the most widespread series can be used as an argument either for their being primitive or more highly evolved ; their morphology supports the latter view.

Another view often taken by plant-geographers is that Tropical species are more likely to be primitive than the temperate species of the same genus. At the first glance this supports the scheme outlined above. The Subgenus *Kalonymus* and Sect. *Melanocarya*, regarded as the most highly evolved, are not found in the Tropics. The Old World Tropical members of Sect. *Illicifolia* should therefore be the most primitive. This raises the question whether the Sino-Japanese region is only an area of secondary species formation or the original home of the genus. A question which can only be answered after considering the *Celastraceae* as a whole, and the claims of the other ligneous genera so well developed in the Sino-Japanese region to have originated there. These two subjects are beyond the scope of the present paper.

An even more thorough application of the theory of the primitive nature of Tropical forms might lead to rather different conclusions. Assuming that the most widespread and commonest species of *Euonymus* in the Tropics are the most primitive, if only in the sense of oldest, then the most primitive species are *E. javanicus* Blume (Ser. *Glomerati*) and the closely related *E. cochinchinensis* Pierre (Ser. *Myrianthi*). These are both species with fimbriate petals. If this assumption is made, it becomes necessary to conclude that the original area of the genus was in S.E. Asia and that subsequent evolution has followed two lines. (1) By reduction to form Sect. *Illicifolia* and then by specialization from it ; (2) by reduction to form the Temperate species of Ser. *Myrianthi* and then by specialization the series derived from these. This seems a needlessly complex theory, if contrasted with the view that Sect. *Illicifolia* is the most primitive, and perhaps it ought to be abandoned on the principle that hypotheses should not be needlessly multiplied.

When the palaeontology is taken into consideration as well as the morphology and geographical distribution, a tentative opinion on the past history of the genus may be hazarded. The genus appears to have been nearly cosmopolitan and already divided into its existing Series and Sections during Tertiary times, when temperate conditions are held to have been more widespread than at present. This view is supported by the fossil evidence as far as I have examined it (p. 221). That the outlying species of the genus in Europe, Central America and Australia all belong to Series well represented in China, might be explained by regarding them either as relicts or as recent invaders. If they were fairly recent invaders one would expect all the Central American species to be most closely related to each other, and all the European species to be close allies ; this is not the case as three and four different Series are found respectively in these areas. Heterogeneity is regarded as a sign of age in a group ; it is, therefore, probable that these species are relicts ; a conclusion already reached by other botanists in the case of *E. nanus* (p. 221). These species may be regarded as evidence that the existing Series were already differentiated before the Ice-Age. Since the worsening of the climate during the Ice-Age the genus has held its own in the Sino-Japanese region and in the adjacent parts of the Continental South-east Asiatic

region. To judge from the "critical" nature of some of the species in this area, species-making is still active there. In the rest of the world only a relatively few species have survived as scattered relicts. In the case of some areas adjacent to the Sino-Japanese region the possibility of invasion since the Ice-Age must be borne in mind.

SEED-DISPERSAL.

Loesener (Pflanzenf. **20B**, 102 (1942)) makes the following remarks on the fruits :—

"Whether the capsules provided with numerous sometimes rather acute processes, as in *Pterocelastrus* as well as in *Euonymus americanus* and *echinatus* and other *Euonymus* species, should perhaps be included among the so-called 'burrs', must at present remain uncertain.—Possibly in a few *Euonymus* species (*E. macropterus* Rupr., *E. sachalinensis* Maxim. and others), the adaptation is for distribution by animals, combined with or replaced by distribution by the wind to which the development of sometimes rather large carinal wings on the capsule appears to point".

Further information is provided by Ridley (Dispersal of Plants, 1930). He regards *Euonymus europaeus* as a bird dispersal plant of an inland habitat. The dry fruit floats for two months, the seed for $2\frac{1}{2}$ days (p. 205). For *E. europaeus*, *E. verrucosus* and *E. oxyphyllus* he records the seed covered by a sweet aril as being eaten by birds, especially blackbirds and thrushes (p. 426) and occasionally robins. He also notes that the seeds of *E. americanus* form part of the food of American Robins and American blue-birds (pp. 477, 479).

Hegi (Ill. Flor. Mitteleur. **5**, I, 246–256 (1925)) also upholds the belief that bird-dispersal is usual in the genus. In *E. europaeus* he states that robins, magpies and thrushes are fond of the seeds. In *E. verrucosus* "transport by water seems not to occur as it is absent in willow enclosures near Weichsel."

The dispersal by birds seems to be well-attested in the literature. It can only be assumed that the poisonous nature of the seeds (p. 227) is confined to the seed proper and is absent from the aril, or that the poison is one to which birds are immune. I have seen thrushes, blackbirds and starlings at times in the *Euonymus* bushes at Kew, but did not satisfy myself, whether they were really feeding on the seeds, or on some insect, or just perching there. Starlings at any rate seem to prefer the fruits of some nearby shrubs of *Pyracantha*. Perhaps there is too wide a choice of diet for seed-eating birds in a botanic garden for observations made there to shed much light on the dispersal of wild-growing shrubs.

The capsules of spiny-fruited species do not appear from herbarium material to be very adhesive. The spines are neither hooked nor barbed in any way nor are they very stiff and prickly. The suggestion that the winged capsules of certain species (Subgenus *Kalonymus* except *E. oxyphyllus*) are an adaptation to wind-dispersal seems rather doubtful. The wings split from below down their centre ; the capsule flattens out giving the appearance of a small parachute with four or five seeds hanging at its edge. If this were evolved as a wind-dispersal mechanism, one would expect the dried capsule to be thinner and more membranous than it actually is. Besides, the capsules, of such of the wing-fruited species as I

have seen in cultivation, do not appear to be carried any further by the wind than the unwinged capsules of other species. If a teleological explanation really must be given, it is perhaps more convincing to assume that the spines, wings and the opening out of the capsule enhance the conspicuousness of a fruit, already attractive to birds by its bright colour and dangling seeds in their red or orange arils. In some species (e.g. *E. verrucosus*, *E. verrucosoides*) the testa is black and only covered by the aril towards the base, a not unusual feature in arillate seeds (Corner, Ann. Bot. **13**, 367-414 (1949)) and one which serves to make the fruit more striking to the eye.

The average weight of the seed of *E. europaeus* is 0.0158 gms. Compared with that of twenty-three other woodland shrubs occurring in Britain, this weight is below the average. In general the larger the supply of food material provided by the parent plant in the seed, or other propagule, the more advanced the phase of succession that the species can generally occupy (Salisbury, The Reproductive Capacity of Plants, 17 (1942)). This seed weight is in accordance with the habitat in which *E. europaeus* is often found, at least in Britain. It usually grows in chalk-scrub and hedges rather than in dense shade.

ECONOMIC.

Euonymus is not at present a genus of major economic importance, but its various minor uses may be briefly indicated here. *E. europaeus*, as well as being an ornamental shrub, has been used as turnery wood, as a source of artists' charcoal, as a dye (extracted from seeds and fruits), as a drug (emetic and purgative), as the source of an oil, which is unfit for human consumption, extracted from the seeds, and the powdered leaves or seeds have been employed to destroy lice (Grieve, Johnson, Hegi, Loesener). Probably many other species are or have been utilized, at least in primitive economy, for similar purposes. The drug euonymin ("Wahoo root" from the root bark of *E. atropurpureus*) is very little used nowadays; it is described in the British Pharmaceutical Codex 1934, but not in the British Pharmacopoeia 1932. The English name of the genus "Spindle" is said to come from the wood having been made into spindles, and the Himalayan *E. tingens* takes its Latin name, according to its original describer, from the Nepalese employing the bark to mark "the forehead with the idolatrous symbol, commonly called Tika." (Wallich, Dymock.).

E. europaeus is poisonous in all its parts especially the fruit. Children, sheep and goats are recorded as having suffered from its effects (Long). The glucoside euonymin from *E. atropurpureus* is described as a heart-poison, whose symptoms are deadly nausea, vertigo, prostration and cold sweat; *E. latifolius* is also regarded as poisonous (Pammel, Hegi).

Of modern work the importance of various species as winter-host of an aphid should be noticed. During the last war in some areas, where sugar beet is grown, the advisability of destroying all shrubs of *E. europaeus* was discussed, and the part played by cultivated species of *Euonymus* in harbouring this aphid was under investigation. It should be noted that *Euonymus* is not the only winter-host of *Aphis fabae* (see p. 210 above and Heeley, Hull, Kennedy below).

There are several papers on the extraction of gutta-percha from various species in Russia. The quantity of gutta-percha is greatest in the bark of the roots less in the stem-bark especially towards the upper parts (Lissin). The gutta-percha content is greatest in spring and autumn, before and after flowering, in several *E. Siberian* as well as European species according to Balandin and Kolesnikov, although Nahapetian states that in *E. europaeus* the maximum is in June and the minimum is in October. *E. verrucosus* has been the species most used for this purpose, at first collected in the wild but later grown in plantations; the bark of the roots gives 6–20% gutta-percha; a form with green flowers is reported as heavier-yielding than the brown-flowered form (Buchholz, Vashkulat).

Further details on these matters may be obtained from the bibliography given here :—

- Balandin, D. A. & B. P. Kolesnikov; "[The content of gutta-percha in the species of *Euonymus* in the Maritime Province]" in *Sovetskaia Botanika* [Leningrad] **1943** (4), 42–54, 1943. [*E. alatus*, *E. pauciflorus*, *E. macropterus*, *E. sachalinensis*, *E. maackii*. Biol. Abs. **20**, 18497].
- Baranovsky, A. L. & T. N. Makavevitch; "Spindle tree *Euonymus europaea* a valuable gutta-percha bearing plant." in *Proc. Lenin. Acad. Agric. Sci. U.S.S.R.* 1942, Nos. 3–4. (I.A.B. Plant Breeding Abstracts. **14** (2) 146. Abstr. 608. 1944).
- Bossé, G. G. & B. M. Maistrovaia; "[Internal factors determining the accumulation of gutta-percha in *Euonymus*]" in *Botanicheskii Zhurnal S.S.S.R.* (Jour. Bot. S.S.S.R.) **23** (2), 89–105 (1938). [*E. europaeus*, *E. verrucosus*, *E. japonicus*. Biol. Abs. **16**, 17051].
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THEOPHRASTUS AND PLINY.

The poisonous properties of *Euonymus* have been referred to above (p. 227). Theophrastus (b. 370 B.C.) is the first writer to comment on them. In A. Hort's translation of "Theophrastus, Enquiry into Plants" III. 18. 13 (1916) the passage runs as follows :

"The tree called the spindle-tree grows, among other places, in Lesbos, on the mountain called Ordynnos. It is as large as the pomegranate and has a leaf like that of that tree, but larger than that of the periwinkle, and soft like the pomegranate leaf. It begins to shoot about the month of Poseideon [January], and flowers in the spring ; the flower in colour is like the gilliflower, but it has a horrible smell, like shed blood. The fruit, with its case, is like the pod of sesame ; inside it is hard, but it splits easily according to its four divisions. This tree, if eaten by sheep, is fatal to them, both the leaf and fruit, and it is especially fatal to goats unless they are purged by it ; and the purging is effected by diarrhoea."

Theophrastus is stated to have been born in Lesbos and might well speak of the tree from personal knowledge. People's idea of a smell, or of the phrase to use to describe it by comparison, differs greatly with the individual. Pliny (1st century AD) seems to have read into the above account rather more than was intended and, in translation, is distinctly ominous on the subject.

"In the Island Lesbos, there groweth a tree named *Euonymus*, no better nor more luckie than *Ostrya* beforesaid. Much unlike it is not to the Pomegranate tree. As for the leafe it beareth, it is a middle size between that of the Pomegranat and the Bay ; otherwise for shape and softness, it resemblenth that of the Pomegranat : the flower is whiter ; the smell and tast whereof is pestiferous and menaceth present death : it beareth cods like to *Sesama*, within which be graines or seeds four square and thicke, but deadly unto all creatures that eat them. The leafe also is a venomous as the graine, yet otherwhiles there ensueth thereof a fluxe and gurie of the belly, which saveth their life, or else there were no way but one." (Philemon Holland ; "The Historie of the World, Commonly called, the Natural Historie of C. Plinius Secundus". **1**, 399 (1601)).

MISCELLANEOUS NOTES.

The generic name has been here spelt *Euonymus* not *Evonymus* in accordance with Dr. Sprague's views on the point (Kew Bull. **1928**, 294-296 (1928)). Rehder (in *Bibliograph. Cult. Trees and Shrubs* p. 405 (1949)) spells it *Euonymus*. In the additions and emendations to the same work

he states that according to Art. 20, 42 and 71 of the Rules of Botanical Nomenclature the name should be spelt *Evonymus*.

Some of the species have had to be placed on imperfect material or from inadequate descriptions, and some doubt is attached to the limits or valid name of certain species, but sufficient material has been examined to be reasonably certain of the main outlines of the genus.

The keys to the Series are artificial, and do not always place the species in the most natural order. Where a species is known from flowering material only (or is otherwise imperfectly known), it may appear in the key of more than one Series, although it is only listed once in the enumeration.

Specimens cited are in the Kew Herbarium, unless otherwise stated.

Grateful acknowledgments for the loan of specimens are due to the Regius Keeper, the Royal Botanic Garden, Edinburgh, the Directors, Royal Botanic Gardens, Calcutta, the Botanic Gardens of Indonesia, Bogor (Buitenzorg) and the Botanic Gardens, Cambridge, as well as to the Keeper of the Department of Botany, British Museum (Natural History) and to the Director, Rijksherbarium, Leyden. I am also indebted to Mr. H. K. Airy Shaw, Kew, for help in preparing the manuscript.

AFFINITIES WITH OTHER GENERA.

Loesener (Pflanzenfam. **20B**, 108 (1942)) gives the following key to the tribe *Evomyeae*.

- A. Petals free. Disc fleshy, expanded, annular or cup-shaped or thick and compact, distinctly or only indistinctly separated from the ovary
- B. Disc variously shaped, distinctly separated from the ovary
- C. Aril present
 - D. Loculi of the ovary containing only 1 ovule each
 - E. Flowers small, only up to 4 mm. in diameter. Erect shrub or tree; West Indies
Torralbasia Krug et Urban
 - EE. Flowers larger with large persistent petals. Climbing shrub; China
Monimopetalum Rehder
 - DD. Loculi of ovary with two or more ovules in each loculus
 - F. Leaves opposite, rarely spirally arranged or in whorls and then small and narrow and under 5 cm. long.—Europe, Asia, Madagascar, Australia, North and Central America
Euonymus L.
 - FF. Leaves spirally arranged, more or less oblong, over 5 cm. long. Aril a one-sided longitudinal cushion—Australia
Hedraianthera F. Muell.
- CC. Aril absent, instead the testa itself thin and fleshy. Flowers unisexual by abortion. Fertile ovary bilocular. Ovules in loculus 2, erect. Capsule dehiscent irregularly or septicidally, often beginning from below—E. Asia
Orthorodendron Makino

BB. Disc compact, thick and only indistinctly separated from the ovary. Loculi of the ovary with only one ovule each. Petals with two pits on the inner (upper) side—S. Asia

Glyptopetalum Thwaites

AA. Petals later united at the base with one another and with the stamens, rarely wanting. Disc none or weakly annular, passing into the stamens—S. Asia, Malaysia, C. America

Microtropis Wall.

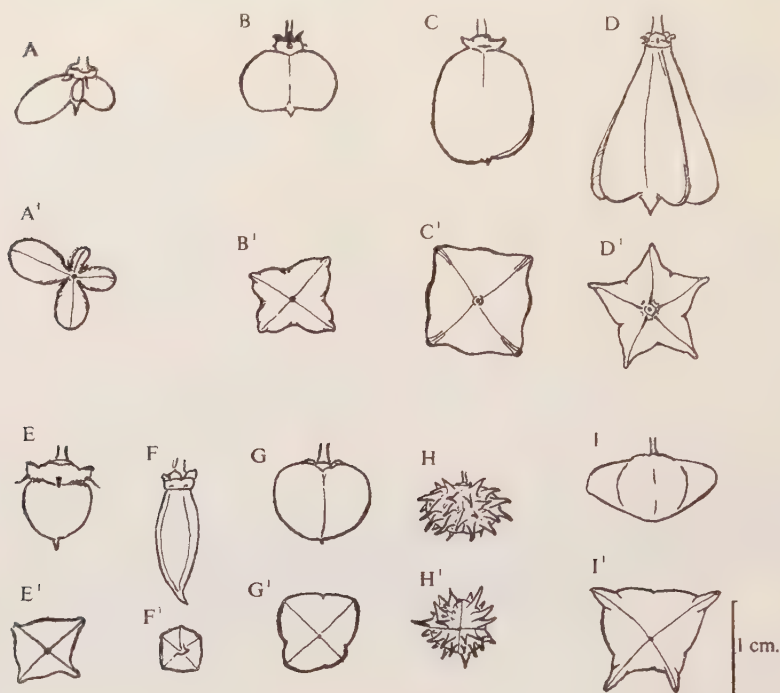


FIG. 1. Lateral and apical view of capsule of :

- | | | |
|---------------------|--|------------------------|
| A, A ¹ . | <i>Euonymus verrucosoides</i> Loes., Ser. Alati, Sect. Melanocaryi | } Subgenus
Euonymus |
| B, B ¹ . | <i>E. bungeanus</i> Max., Ser. Lophocarpi, Sect. Biloculares. | |
| C, C ¹ . | <i>E. myrianthus</i> Hemsl., Ser. Myrianthi, Sect. Biloculares. | |
| D, D ¹ . | <i>E. indicus</i> Heyne, Ser. Glomerati, Sect. Biloculares. | |
| E, E ¹ . | <i>E. grandiflorus</i> Wall., Ser. Grandiflori, Sect. Multiovulatus. | |
| F, F ¹ . | <i>E. recurvans</i> Miq., Ser. Fusiformes, Sect. Stenocarpus. | |
| G, G ¹ . | <i>E. japonicus</i> Thunb., Ser. Japonici, Sect. Illicifolia. | |
| H, H ¹ . | <i>E. scandens</i> R. Graham, Ser. Echinati, Sect. Echinococcus. | |
| I, I ¹ . | <i>E. monbeigii</i> W. W. Sm., Ser. Macrogemmi, Subgenus | |
| | Kalonymus | |

CONSPECTUS GENERIS EUONYMI.

Subgenus A. **Euonymus** Beck emend.

Beck Fl. Nied.-Oesterr. 2, 1, 588 (1892).

Gemmae hiemales saepissime parvae, ovoidae, acutae. Stamina filamenta evoluta vel antherae subsessiles; duabus thecis apice haud confluentibus vel imperfecte confluentibus duabus rimis distinctis dehiscentibus (fig. III). Capsula varia, si oblato-globosa tum haud alata. (Typus *E. europaeus* L.).

Sectio I. **Melanocarya** (Turcz.) Nakai emend. in Journ. Jap. Bot. **17**, 615–618 (1941); Turcz. in Bull. Soc. Nat. Mosc. **31**, II, 453 (1858) pro gen.; Nakai in Act. Phytotax. Geobot. **13**, 30 (1943) pro subgen.) Capsula fere ad basin partita, laevis (fig. IA, IIB, 3). (Typus *E. alatus* (Thunb.) Regel).

Series 1.—**Alati** ser. nov. Folia decidua, crebre serrata. (Typus *E. alatus*).

Series 2.—**Vyenomi** (Presl.) stat. nov. (*Vyenomus* Presl, Bot. Bemerk. 32 (1844) (in Abh. Boehm. Ges. **5**, III, 462 (1845)) pro gen.; Nakai l.c. pro sect. et subgen). Folia sempervirentia, crebre vel distantius serrata. (Typus *E. pendulus* Wall.).

Sectio II. **Biloculares** Rouy et Fouc. Fl. France **3**, 158 (1897).

(Sect. *Pragmotesera* Pierre sec. Nakai l.c.; vix Pierre Fl. For. Cochinch. fasc. 20, t. 309 (1894) pro gen.). Capsula usque vel haud usque ad medium loculum lobata, lobis angulatis vel carinatis, apice retusa vel truncata saepe apiculata, laevis vel parum rugosa (fig. IB, C, D, IID). (Typus *E. europaeus* L.).

Series 3.—**Lophicarpi** (Loes.) stat. nov. et emend. (Sect. *Lophocarpi* Loes. in Engl. et Harms Pflanzenfam. ed. 2, **20B**, 121 (1942)). Ramuli laeves. Folia decidua, opposita, majuscula (maxima 9–16 cm. longa), lanceolata vel ovata. Petioli longi (maxima 6–30 mm. longi). Flores 4-meri (5-meri in *E. occidentali*). Petala integra vel breviter dentata. Capsula obovoidea vel obcordata (fig. IB). (Typus *E. europaeus* L.).

Series 4.—**Myrianthi** ser. nov. Ramuli laeves. Folia semper-virentia, opposita, raro ternatim verticillata, ovata vel linearilanceolata, 5.5–24 cm. longa. Petioli maximi 0.3–3 cm. longi. Infl. saepissime multiflora (3–120 fl.) raro 1–3-fl. (1-fl. in *E. walkeri*). Pedunculi saepissime ultra 1 cm. longi usque 8 cm. longi (2 mm. in *E. walkeri*). Flores 4–5-meri. Petala integra, breviter dentata vel fimbriata. Capsula obovoidea vel obcordata (clavata in *E. thwaitesii*, *E. walkeri*, apiculata in *E. macrocarpo*) (Fig. IC). (Typus *E. myrianthus* Hemsl.).

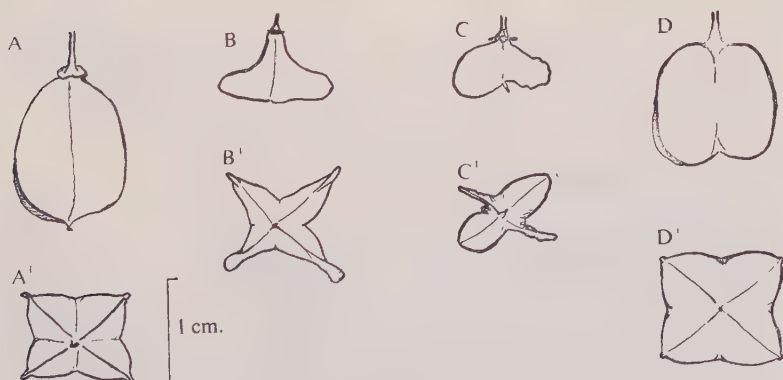


FIG. II. Lateral and apical view of capsule of:

- A, A'. *Euonymus javanicus* Blume var. *timorensis* (Zipp.) Miq., Ser. Glomerati.
 B, B'. *E. lawsonii* Clarke, Ser. Vyenomus, Sect. Partitus.
 C, C'. *E. pendulus* Wall., Ser. Vyenomus, Sect. Partitus.
 D, D'. *E. viburnoides* Prain, Ser. Myrianthi, Sect. Biloculares.

Series 5.—**Glomerati** (Loes.) stat. nov. (Loes. l.c. 120 pro sect.).
 Ramuli laeves. Folia sempervirentia, opposita, ovata, elliptica vel oblonga. Petioli usque 13 mm. longi. Infl. 1–3-fl. Pedunculi nulli vel usque 3.5 cm. longi. Petala fimbriata. Capsula saepissime clavata (obcordata in *E. javanico* var. *sphaerocarpo*), apiculata raro retusa (fig. ID). (Typus *E. javanicus* Blume).

Series 6.—**Pseudovyenomi** (Nakai) stat. nov. (Sect. *Pseudovyenomus* Nakai l.c.). Ramuli verrucosi (verrucis nigris vel fusco-griseis) vel laeves. Folia decidua, opposita, ovata vel lineari-lanceolata, parva, usque 10 cm. longa (si ultra 5 cm. tum ramulis verrucosis). Petioli breves usque 5 mm. longi. Infl. 1–7-fl. Petala integra vel breviter dentata. Capsula obovoidea vel obcordata. (Typus *E. pauciflorus* Max.).

Series 7.—**Nanevonymi** (Loes.) stat. nov. (Loes. l.c. 124 pro “Reihe”). Ramuli laeves. Folia sempervirentia, alterna rarissime opposita (in *E. lichiangensi*), lineares, lineari-oblongi vel oblanceolata, usque 5 cm. longa. Petioli subnulli vel usque 5 mm. longi. Infl. 1–5-fl. Pedunculi 2–20 mm. longi. Flores 4–5-meri. Petala integra vel breviter dentata. Capsula obovoidea vel obcordata. (Typus *E. nanus* M.B.).

Seccio III. **Multiovalatus** Loes. l.c. 121 (1942) (*Genitia* Nakai l.c. 21 (1943) pro gen.). Capsula ovoidea, apice obtusa vel rotundata, apiculata, laevis, lobis carinatis usque ad medium loculum lobatis. Discus magnus, c. 6–8 mm. diam. (in sectionibus aliis discus parvus c. 2–5 cm. diam.) (fig. I E). (Typus *E. grandiflorus* Wall.).

Series 8.—**Grandiflori** ser. nov. Folia sempervirentia vel semipersistencia (decidua in *E. grandifloro*), opposita vel alterna. (Typus *E. grandiflorus* Wall.).

Seccio IV. **Stenocarpus** sect. nov. Capsula elobata, fusiformis, acuta, laevis (fig. IF). (Typus *E. fusiformis* Parker).

Series 9.—**Fusiformes** ser. nov. Folia sempervirentia. (Typus *E. fusiformis* Parker).

Seccio V. **Ilicifolia** Nakai l.c. emend. Capsula haud vel parum lobata (lobis rotundatis), globosa vel oblato-globosa, apice rotundata nonnunquam parum retusa, laevis vel parum rugosa vel squamata, 4-mera (3- 5-mera in *E. chloranthoide*) (fig. IG). (Typus *E. japonicus* L. f.).

Series 10.—**Japonici** ser. nov. Folia sempervirentia. (Typus *E. japonicus* L. f.).

Seccio VI. **Echinococcus** Nakai emend. Capsula haud vel parum lobata (lobis rotundatis), globosa vel oblato-globosa, tuberculata vel echinata (fig. IH). (Typus *E. echinatus* Wall.).

Series 11.—**Tuberculati** (Loes.) stat. nov. (Loes. l.c. 121 pro sect.). Folia decidua. Flores 5-meri. (Typus *E. americanus* L.).

Series 12.—**Echinati** (Loes.) stat. nov. (Loes. l.c. 119 pro sect.). Folia sempervirentia (decidua in *E. chenmoui*). Flores 4-meri. (Typus *E. echinatus* Wall.).

Subgenus B. **Kalonymus** Beck emend.

Beck—Fl. Nied. Oesterr. l.c. (Subgen. *Turibana* Nakai l.c. 31 (1943) ; genus *Kalonymus* (Beck) Prokh. in Fl. S.S.S.R. **14**, 744 (1949)).

Gemmae hiemales saepissime majores, conicae, acutissimae. Stamina subsessilia ; antherae late reniformes, thecis unicus apice confluentibus rima continua dehiscens, post dehiscens patelliformes (fig. IV). Capsula oblato-globosa, parum lobata, alata (raro haud alata) (fig. I, 1). (Typus *E. latifolius* (L.) Mill.).

Seccio VI. **Uniloculares** Rouy et Fouc. l.c. (Sect. *Penteuonymus* Nakai l.c.). Ut in subgenere. (Typus *E. latifolius* (L.) Mill.).

Series 13.—**Macrogemmi** (Nakai) stat. nov. (Sect. *Macrogemmum* Nakai l.c. ; Sect. *Tricarpus* Nakai l.c. ; Sect. *Penteuonymus* Nakai l.c.). Folia decidua (semipersistentia in *E. latifolius* var. *sempervirens*). (Typus *E. macropterus* Rupr.).

Series 14.—**Cornuti** (Loes.) stat. nov. (Loes. l.c. 120 pro sect.) Folia sempervirentia vel semipersistentia. (Typus *E. cornutus* Wall.).

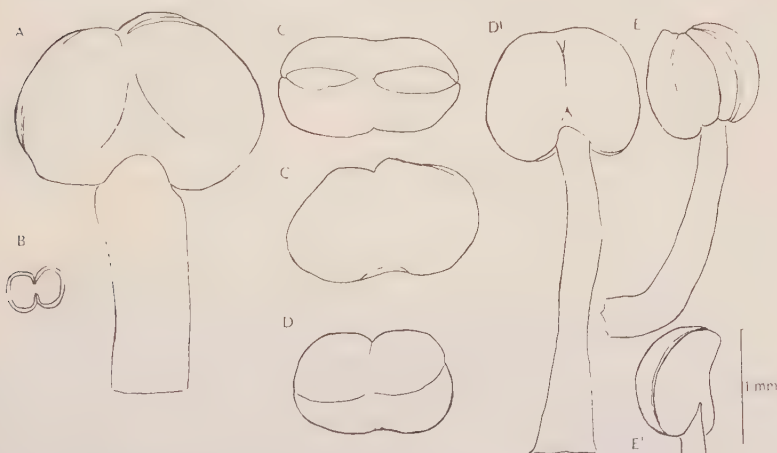


FIG. III. Stamen of Subgenus *Euonymus* :

- A. *Euonymus grandiflorus* Wall., ventral view.
- B. *E. nanus* M.B., dehiscent, apical view.
- C, C'. *E. myrianthus* Hemsl., apical and ventral view.
- D, D'. *E. phellomanus* Loes., apical and ventral view.
- E, E'. *E. kiautschovicus* Loes., adaxial and lateral view.

KEY TO SUBGENERA, SECTIONS AND SERIES.

- A. Winter buds usually ovoid, acute, small. Stamen with filaments or subsessile, anthers with two thecae not confluent or imperfectly confluent on dehiscence, dehiscing by two distinct splits (fig. III). Capsule various (if oblate-globose then not winged)

Subgenus **Euonymus** p. 237

- B. Capsule partite almost to base (fig. IA, IIB, C)

Sect. I. **MELANOCARYA**

- C. Leaves deciduous

Ser. 1. *Alati* p. 237

- CC. Leaves evergreen

Ser. 2. *Vyenomi* p. 240

BB. Capsule unlobed or lobed to $\frac{1}{2}$ width of loculus

D. Capsule smooth or at most slightly rugose

E. Capsule \pm lobed, or angled, apex retuse, retuse-apiculate, acute or obtuse (sometimes rounded in *E. myrianthus*)

F. Capsule obcordate to clavate

G. Capsule retuse or apiculate (sometimes rounded in *E. myrianthus*). Disc 2–5 mm. diam. (fig. IB, C, D)

Sect. II BILOCULARES

H. Leaves large up to 5.5–24 cm. Petiole usually long, 0.3–3 cm. long. Twigs smooth

I. Leaves deciduous

Ser. 3. *Lophocarpi* p. 242

II. Leaves evergreen

K. Inflorescence usually many flowered (3–120 fl.) rarely 1–3 fl. Petals entire, dentate or fimbriate (if fimbriate then peduncle up to 4–8 cm. long)

Ser. 4. *Myrianthi* p. 247

KK. Infl. 1–3-fl. Peduncle almost none or up to 3.5 cm. long. Petals fimbriate

Ser. 5. *Glomerati* p. 256

HH. Leaves small, usually up to 5 cm. long (if over 5 cm. long, then twigs verrucose with black or grey warts). Petioles up to 5 mm. long

L. Leaves deciduous, opposite

Ser. 6. *Pseudovenomi* p. 258

LL. Leaves evergreen, alternate or verticillate (opposite in *E. lichiangensis*)

Ser. 7. *Nanevonymi* p. 260

GG. Capsule obtuse to rounded. Disc c. 6–8 mm. diam. (fig. IE)

Sect. III. MULTIOVULATUS
(Ser. 8. *Grandiflori*) p. 261

FF. Capsule fusiform (fig. IF)

Sect. IV. STENOCARPUS
(Ser. 9. *Fusiformes*) p. 262

EE. Capsule apex rounded sometimes slightly retuse, unlobed or with shallow rounded lobes (fig. IG)

Sect. V. ILICIFOLIA
(Ser. 10. *Japonici*) p. 262

DD. Capsule echinate (fig. IH)

Sect. VI. ECHINOCOCCUS

M. Leaves deciduous. Flowers 5-merous

Ser. 11. *Tuberculati* p. 270

MM. Leaves evergreen (except *E. chenmoui*). Flowers 4-merous

Ser. 12. *Echinati* p. 273

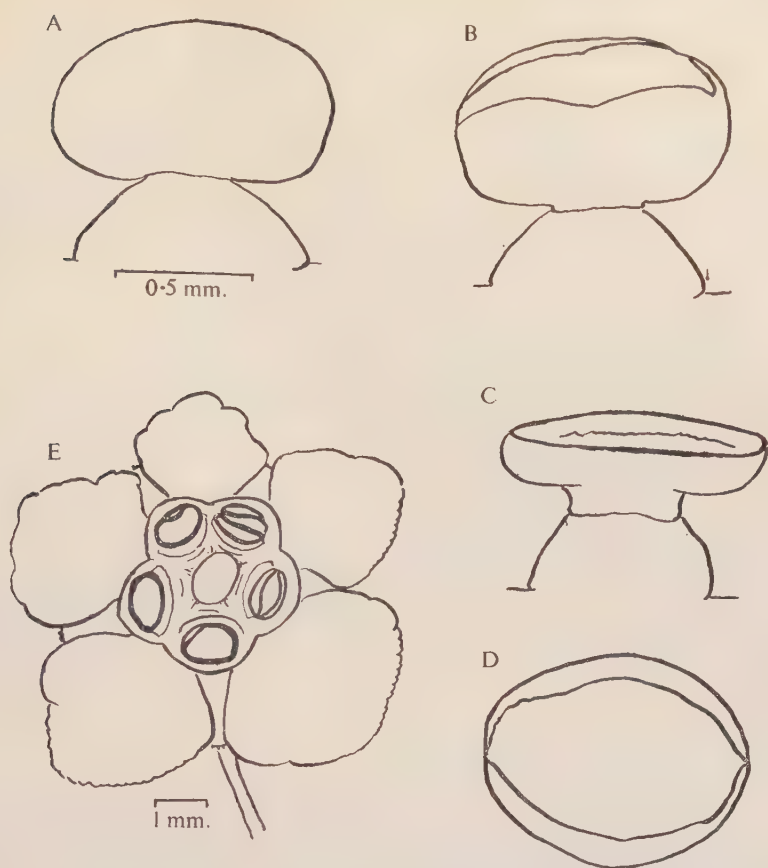


FIG. IV. *Euonymus latifolius* (L.) Mill. (Subgenus *Kalonymus*).

A-C Lateral view of stamen showing dehiscence.

D Apical view of anther after dehiscence.

E Apical view of flower.

- AA. Winter buds usually conic, very acute, large. Stamen subsessile, anther of one theca dehiscing by one continuous split, after dehiscence patelliform (fig. IV). Capsule oblate-globose winged (unwinged in *E. oxyphyllus*) (fig. I)

Subgenus **Kalonymus** p. 275

- N. Leaves deciduous (semipersistent in *E. latifolius* f. *sempervirens*)

Ser. 13. *Macrogemmi* p. 275

- NN. Leaves evergreen or semipersistent

Ser. 14. *Cornuti* p. 282

SUBGENUS EUONYMUS BECK.

KEY TO SERIES 1. ALATI SER. NOV.

- A. Leaves crenate-serrate, veins not prominent below, filaments long (1.5–2 mm. long), seed black much exposed by aril
- B. Petals red

1. *verrucosoides* Loes.

long, 2–4.5 cm. wide, rounded oval, obovate-oval or elliptic, glabrous, branches unwinged.

SERIES 1. ALATI SER. NOV.

1. **E. verrucosoides** Loes. in Engl. Bot. Jahrb. **30**, 462 (1902) (*E. striatus* var. *apertus* Loes. ex Sargent Pl. Wils. **1**, 494 (1913)). S.E. Tibet, China (Hupeh, Kansu, Shensi, Yunnan).
var. **viridiflorus** Loes. et Rehd. ex Sargent Pl. Wils. l.c. 493. China (Kansu, Szechwan);
2. **E. alatus** (Thunb.) Siebold in Verh. Batav. Genoot. Kunst. Wetensch. **12**, 49 (1830) (*Celastrus striatus* Thunb., *Celastrus alatus* Thunb., *E. striatus* (Thunb.) Loes., *E. thunbergianus* Blume, *E. loesneri* Makino, *Melanocarya alata* Turcz., *Microhamnus taquetii* Lévl. teste Rehd.). S.E. Siberia, Manchuria, Korea, Japan, China (Chekiang, Kiangsu, Shantung, Chihli, Hupeh, Kiangsi, Honan, Anwhei, Kansu, Shensi, Szechwan, Yunnan, Kweichow). This distribution includes varieties.
var. **apterus** Regel Fl. Ussur. 43 (1862) (*subtriflorus* (Blume) Franch. et Sav. Enum. Pl. Jap. **2**, 311 (1879)).
f. **angustatus** Makino in Bot. Mag. (Tokyo) **25**, 229 (1925).
f. **angustus** Makino ex Makino et Nemoto Cat. Jap. Pls. in Tokyo Imp. Mus. 174 (1914) nomen nudum?
var. **ciliato-dentatus** Franch. et Sav. Enum. Fl. Jap. **2**, 311 (1879).
f. **compactus** (Adams) Rehd. in Journ. Arn. Arb. **20**, 418 (1939).
coloratus Marchant Choice Trees, Shrubs, Wall Plants and Climbs. 78 (1929) (no rank given).
var. **cornucarpus** Koidz. in Act. Phytotax. et Geobot. 56 (1941).
var. **hirtus** Koidz. in Bot. Mag. (Tokyo) **39**, 10 (1925) (var. *pubescens* Max. p.p.).
var. **macrophyllus** Nakai in Journ. Jap. Bot. **19**, 365 (1943) Japan.
var. **microphyllus** Nakai Rep. on Veg. of Oooryongto or Dagelet Is., Korea 22, 37, 38 (1919) descr. in Japanese; Wang in Contrib. Bot. Surv. N.W. China **1**, 18 (1939).
var. **pubescens** Max. in Bull. Acad. Imp. Sci. Petrop. **27**, 454 (1881) (var. *pilosus* Loes. et Rehd. ex Sargent Pls. Wils. **1**, 494 (1913)).
var. **pubescens** Max. f. **variegatus** Nakai in Journ. Jap. Bot. **19**, 365 (1943) Japan.
var. **rotundatus** Makino ex Koidz. in Bot. Mag. (Tokyo) **25**, 229 (1911); (*E. rotundatus* (Makino) Nakai in Jap. Bot. Mag. **17**, 615–618 (1941)).
var. **typicus** Regel Fl. Ussur. 43 (1862) (var. *alatus* (Thunb.) Makino in Bot. Mag. (Tokyo) **25**, 229 (1911), ssp. *alatus* (Thunb.) Koidz. in l.c. **39**, 10 (1925), var. *verus* Kitagawa in Rep. Inst. Sci. Res., Manchoukuo **3**, app. 1, 307 (1939)).

In this series, but position uncertain :

3. **E. sacrosanctus** Koidz. in Bot. Mag. (Tokyo) **39**, 12 (1925) e descr. Japan. Possibly only a var. of *alatus*.

4. **E. kawachianus** Nakai Bot. Mag. (Tokyo) **35**, 145 (1921) e descr. Japan. Placed in this series by Nakai in Journ. Jap. Bot. **17**, 618 (1941).

KEY TO SERIES 2. VYENOMI (PRESL.) STAT. NOV.

- A. Flowers 5-merous (rarely 4-merous) ; peduncles stout 1.3–6.5 cm. long ; infl. 6–15-fl.

5. *pendulus* Wall.

- AA. Flowers 4-merous ; peduncles slender ; infl. 1–7-fl.

- B. Capsule under 5 mm. long (from base to scar of stigma), base not cuneate, more deeply lobed ; peduncle under 1 cm. long

- C. Leaves large 5–16 cm. long, 2–4 cm. wide ; petioles up to 1 cm. long

- D. Veins on leaves little prominent, scarcely reticulate on either surface, serrations usually obtuse

- E. Flowers 6–7 mm. diam. ; infl. 2–7 (rarely 1)-fl.

- (i) Leaves lanceolate (rarely ovate-lanceolate)

6. *dielsianus* Loes.

- (ii) Leaves wider, oblong, or suboval-oblong

6. *dielsianus* Loes. var. *latifolius* Loes.

- (iii) Leaves obovate or oblong, more abruptly acuminate, more densely serrate fruiting peduncle longer

6. *dielsianus* Loes. var. *fertilis* Loes.

- EE. Flowers 15 mm. diam. ; infl. up to 13-fl.

6. *dielsianus* Loes. var. *euryanthus* Hd.-Mzz.

- DD. Veins on leaves more prominent, more reticulate on both surfaces, serrations acute

7. *leclerei* Lévl.

- CC. Leaves smaller, up to 11.5 cm. long, 4.3 cm. wide ; petioles up to 4 mm. long

- F. Veins on leaves prominent below

- G. Flowers (where known) 6–10 mm. diam. across petals leaves \pm rounded at base ; serrations dense or distant

- H. Leaves up to 11.5 cm. long, 4.3 cm. wide, lanceolate

- I. Twigs 4-angled or narrowly 4-winged

- J. Leaves elliptic-lanceolate, oblong-lanceolate or lanceolate

- K. Leaves oblong-lanceolate, thin, serrations dense and very acute

*Twigs 4-angled or subulate, wings scarcely 0.25 mm. wide, not enlarged at nodes ; petioles 1–3 mm. long, leaves not auriculate at base

8. *centidens* Lévl

**Twigs 4-winged, wings up to 1 mm. wide, widest just below each node ; leaves subsessile auriculate at base

9. *streptopterus* Merrill

- KK. Leaves lanceolate or elliptic-lanceolate up to 3 cm.

wide, more coriaceous, serrations more distant and obtuse

14. *lutchuensis* Ito.

JJ. Leaves ovate, thick, serrations distant and more obtuse

15. *tashiroi* Max.

II. Twigs terete ; flowers unknown

L. Leaves 4–9.5 cm. long, 1.3–4.3 cm. wide ; pedicels 4–6 mm. long

10. *euscaphis* Hd.-Mzz.

LL. Leaves 5–11.5 cm. long, 0.8–1.6 cm. wide ; pedicel. 10–15 mm. long

10. *euscaphis* var. *gracilipes* Rehder

HH. Leaves up to 4.6 cm. long, 2 cm. wide elliptic ; fls. 10 mm. in diam.

11. *distichus* Lévl.

GG. Flowers 10–11 mm. diam. ; leaves cuneate at base, serrations more distant and obtuse

12. *acutorhombifolius* Hayata

FF. Veins on leaves not prominent or very slightly prominent below

M. Leaves narrow lanceolate, up to 2 cm. wide ; creeping shrub ?

13. *gracillimus* Hemsl.

MM. Leaves lanceolate or elliptic-lanceolate up to 3 cm. wide ; small tree

14. *lutchuensis* Ito.

B. Capsule 6–10 mm. long (from base to stigma scar), base \pm cuneate, less deeply lobed ; peduncle 1–8 cm. long

N. Leaves lanceolate, elliptic or oblong

16. *lawsonii* C. B. Clarke

NN. Leaves linear or linear-lanceolate

16. *lawsonii* var. *salicifolius* (Loes.) stat. nov.

SERIES 2. VYENOMI (PRESL.) STAT. NOV.

5. **E. pendulus** Wall. ex Roxb. Fl. Ind. ed Carey **2**, 406 (1824) (*E. japonicus* Wall. ; *E. lucidus* D. Don ; *Vyenomus pendula* Presl. ; *Pragmotessera pendula* Pierre). India (Himalaya), N. Assam.

6. **E. dielsianus** Loes. ex Diels in Engl. Bot. Jahrb. **29**, 440 (1900). China (Hainan, Hupeh).

var. **euryanthus** Hd.-Mzz. in Symb. Sin. **7**, 661 (1933) e descr. China (Hunan).

var. **fertilis** Loes. l.c. 441. China (Kweichow, Szechwan).

var. **latifolius** Loes. l.c. **30**, 455 (1902) (*E. cavaliieri* Lévl. teste Loes.) China (Hupeh, Yunnan).

7. **E. leclerei** Lévl. in Fedde Rep. **13**, 260 (1914). China (Kweichow).

8. **E. centidens** Lévl. l.c. 262. China (Yunnan).

9. **E. streptopterus** Merrill in Sunyatsenia **1**, 198 (1938). China (Kwantung, Kiangsi). A specimen at the British Museum "Kiangsi: Oo Chi Shan, Lungnan district, 1934, Lau 4555" shows fruit.
10. **E. euscaphis** Hd.-Mzz. in Anz. Akad. Wiss. Wien. Math.-Nat. **58**, 148 (1921) e descr. China (Hunan).
var. **gracilipes** Rehd. in Journ. Arn. Arb. **8**, 158 (1927) e descr.
11. **E. distichus** Lévl. in Fedde Rep. **13**, 261 (1914). China (Kweichow). The type specimen seen while on loan by courtesy of the Regius Keeper, Herb. Edinb., shows only flowers, leaves and twigs. It differs only from *E. alatus* var. *apterus* Regel in the evergreen leaves, which persist on wood one year old. The other characters which Loesener (in Ber. Deutsch. Bot. Ges. **32**, 540 (1914)) uses to separate the two species, are found to be invalid when a sufficient range of material of the latter species is examined. Rehder described the young fruit as having shorter and broader lobes than in *E. alatus*. The fruiting specimen was from the type locality (in Journ. Arn. Arb. **14**, 249 (1933)).
12. **E. acutorhombifolius** Hayata in Ic. Pl. Formos. **3**, 56 (1913). (*Glyptopetalum acutorhombifolium* (Hayata) Nakai e Hou in Taiwaniana **1**, 186 (1950)). Formosa.
13. **E. gracillimus** Hemsl. in Journ. Linn. Soc. **23**, 119 (1886). China (Hupeh, Szechwan).
14. **E. lutchuensis** Ito in Journ. Coll. Sci. Tokyo **12**, 372 (1900). Liukiu Is. The only specimen seen is "Yenka, Mt. Kunchow, 6.3.1917, Wilson 8108" (no fls. no frs. ; Brit. Mus.).
15. **E. tashiroi** Max. in Bull. Acad. Sci. St. Petersb. **31**, 23 (1887). Liukiu Is. The only specimen seen is "Yenka, Mt. Kunchow, 6.3.1917, Wilson 8075."
16. **E. lawsonii** C. B. Clarke ex Prain in Journ. As. Soc. Bengal **73**, 195 (1904) (*E. georgei* Comb.). E. Himalaya, N. Assam. The shape of the capsule approaches that of the *Myrianthi* Series.
var. **salicifolius** (Loes.) in Engl. Bot. Jahrb. **30**, 458 (1902) *stat. nov.* China (Yunnan).

KEY TO SERIES 3. LOPHOCARPI (LOES.) STAT. NOV.

- A. Petals purple, fls. 4 or 5-merous
- B. Infl. 6–15-fl., fls. 4-merous
- C. Leaves ovate-elliptic or elliptic, shortly acuminate or acute, pubescent below
 17. *atropurpureus* Jacq.
 - CC. Leaves lanceolate, acuminate, glabrous below
 17. *atropurpureus* Jacq. var. *cheatumi* Lundell.
 - BB. Infl. 1–6-fl., fls. 5-merous ; leaves glabrous below
 - D. Infl. 1–5-fl.
 18. *occidentalis* Nutt.
 - DD. Infl. 3–6-fl.
 18. *occidentalis* Nutt. var. *parishii* (Trel.) Jepson.

- AA. Petals white, greenish or yellowish, fls. 4-merous
- E. Anthers yellow
- F. Twigs densely pubescent
19. *velutinus* F. et M.
- FF. Twigs glabrous (for vars. see separate key)
20. *europaeus* L. et vars.
- EE. Anthers purple or dark red
- G. Twigs not winged
- H. Leaves with shorter petiole, less long acuminate
21. *hamiltonianus* Wall.
- *Capsules pink and red
- I. Leaves generally narrow or wide lanceolate
- J. Aril orange
- K. Leaves lanceolate, acuminate, aril closed or little open
- (i) Leaves up to 3 or more cm. wide, lanceolate
21. *hamiltonianus* var. *maackii* (Regel) Komarov.
- (ii) Leaves up to 2 cm. wide, narrow lanceolate to ovate
21. var. *maackii* f. *lanceolatus* Rehd.
- KK. Leaves wide lanceolate to ovate, acute
- L. Aril wide open, exposing $\frac{1}{2}$ the blood-red seed
21. *hamiltonianus* var. *semiexsertus* (Koehne) stat. nov.
- LL. Aril little open, seed "rosea"
21. *hamiltonianus* var. *lanceifolius* (Loes.) stat. nov.
- LLL. Aril little open, seed green
21. *hamiltonianus* var. *nikoensis* (Nakai) stat. nov.
- JJ. Aril blood red, little or fairly wide split, seed blood red
21. *hamiltonianus* var. *hians* (Koehne) stat. nov.
- II. Leaves generally wide obovate; aril orange, closed or little open
21. *hamiltonianus* var. *yedoensis* (Koehne) stat. nov.
- (i) Leaves short pubescent on the midrib and veins below
21. var. *yedoensis* f. *koehneanus* Loes.
- (ii) "Fructus intense kermesino-roseus"
21. var. *yedoensis* f. *calocarpus* Koehne.
- **Capsules yellow ("ochroleuco"), a luxuriant large-leaved and many flowered form
21. *hamiltonianus* var. *australis* Komarov
- HH. Leaves with long petiole, lamina broad at the base suddenly narrowed into a long point
22. *bungeanus* Max.
- (i) differs from type "praecipue cum foliis longe petiolis dependentibus, sed folia latiora, capsulae sulcato-4-lobatae maturite erubescences"
22. *bungeanus* var. *mongolicus* (Nakai) Kitagawa
- (ii) Branches and twigs pendulous
22. *bungeanus* f. *pendulus* Rehd.

GG. Twigs with 4 conspicuous corky wings

23. *phellomanus* Loes.

Key to varieties of *E. europaeus* L.

A. Shrub or small tree

B. Leaves elliptic-ovate to narrow lanceolate

C. Leaves elliptic-ovate to lanceolate-oblong, 3–8 cm. long

D. Leaves green

E. Leaves glabrous or glabrescent below

(1) Fruit red to pink

var. *typicus* Max.

(2) Fruit bright pink on long pendulous peduncles

var. *aldenhamensis* Gibbs

(3) "Fruit d'un rouge plus vif"

var. *ardens* Mouillef.

(4) Fruit crimson

var. *atrorubens* Rehd.

(5) Fruit whitish

var. *albus* West.

EE. Leaves pilose below, at least on veins

(6) Leaves shortly pilose on veins

subf. *pubescens* (Stev.) Hayek

(7) Leaves elliptic, 2–3 cm. long, 1–1.8 cm. wide, base scarcely cuneate, apex rounded, scabrid below on veins

var. *microphyllus* Beck.

(8) Leaves with numerous glaucous glands; twigs and capsule glandulose

var. *glaucescens* E. Busch.

(9) Leaves subretuse, scabrid below on veins

var. *scaberulus* Beck.

DD. Leaves variegated

(10) Leaves blotched with yellow

var. *variegatus* Dippl.

(11) Leaves variegated with white

var. *argenteo-variegatus* Bean.

CC. Leaves narrower

(12) Leaves green, narrow lanceolate, 2–4-fl. infl., capsule smaller

var. *angustifolius* K. F. Schultz.

(13) Rather narrow purplish leaves

var. *atropurpureus* Mouillef.

BB. Leaves ovate to broad elliptic, rounded or nearly so at base, larger; capsules bright red

var. *intermedius* Gaud.

AA. Dwarf dense upright form with elliptic to lanceolate-elliptic leaves 2–3 cm. long

var. *pumilus* Loud.

The following two varieties are possibly abnormal specimens :

var. *fibrilliferus* (F. et M.) Medw. Leaves pubescent below ; margin of disc fibrilliferous.

var. *monstruosus* Mouillef. Branches short thick.

SERIES 3. LOPHOCARPI (LOES.) STAT. NOV.

17. **E. atropurpureus** Jacq. Hort. Vindob. **2**, 55 (1773-4). (*E. latifolius* Marsh, *E. carolinensis* Marsh, *E. tristis* Salisb.) N. America (Ontario to Florida, Montana, Nebraska, and Oklahoma teste Britton and Brown).
var. **cheatumi** Lundell in Contrib. Univ. Mich. Herb. **6**, 41 (1941) e descr. Texas.
var. **grandifolius** Raf. New Fl. Amer. **3**, 60 (1836) e descr.
var. **latifolius** Raf. l.c. e descr.
var. **oblongifolius** Raf. l.c. e descr.
18. **E. occidentalis** Nutt. ex Torr. et Gray Fl. N. Amer. **1**, 258 (1838). (*E. atropurpureus* Hook. non Jacq.) N. America.
var. **parishii** (Trel.) Jepson Man. Pl. Californ. 610 (1925). California.
19. **E. velutinus** (C.A.M.) Fisch. et C.A.M. (in Bull. Soc. Nat. Mosc. 337 (1838) (*E. europaeus* L. var. *velutinus* C.A.M. Verzeich. Pfl. Cauc. Casp. 134 (1831)). Caucasus, Armenia, N. Persia, Transcaspia.
20. **E. europaeus** L. Sp. Pl. 197 (1753) (*E. europaeus* var. *tenuifolius* L. 1753, *E. vulgaris* Mill. 1768, ? *E. acuminatus* Raf. 1836, ? *E. cuneatus* Raf. 1836, ? *E. heterophyllus* Raf. 1836, *E. quadrigonus* Gueldenst. ex Ledeb. 1842, *E. floribundus* Stev. 1856, *E. tenuifolius* Dalla Torre et Sarnth. 1909). Europe, Asia Minor. Rehder in Bibl. Cult. Trees and Shrubs 405 (1949) makes this species the lectotypus of the genus.

The following enumeration of the varieties and forms of this species is probably not exhaustive. The key and enumeration are compiled from the descriptions. Specimens of many of them have not been seen.

- subsp. **angustifolius** K. F. Schultz ex Rchb. Fl. Germ. Ex. 827 (1830-32).
- var. **albus** West in Bot. Univ. **1**, 103 (1770) (var. *leucocarpus* DC., fr. albo Hort., fructu-albo Bean, l.c.)
- var. **aldenhamensis** Gibbs in Gard. Chron. Ser. 3, **72**, 243, 253 (1922).
- var. **ardens** Mouillef. Traité d. Arb. et Arbrisseaux **2**, 748 (1892-8).
- var. **argenteo-variegatus** Bean Trees & Shrubs Hardy in Brit. Is. ed. 1, **1**, 539 (1914).
- var. **atrорubens** Rehd. l.c. (var. fr. *atropurpureus* Hort.).
- var. **atropurpureus** Mouillef. l.c. (var. *purpureus* Bean l.c.).
- var. **australis** Komarov in Act. Hort. Petrop. **22**, 710 (1904) e descr. Himalaya, China.

- var. **borbasianus** *Karpati* in *Borbasia* **1**, 100–105 (1939) ; *Biol. Abs.* **18**, 22484, descr. non vidi.
- var. **fibrilliferus** (*F. et M.*) *Medw.* ex *Busch* *Fl. Cauc. Crit.* **3**, VIII, 36 (1912).
- var. **glaucescens** *Busch*. l.c. 32.
- var. **intermedius** *Gaud.* *Fl. Helvet.* **2**, 226 (1828), (var. *bulgaricus* (Vel.), var. *grandifolius* Form., var. *latifolius* Gilib. ex *Dipp.*, var. *macrophyllus* Schliech., var. *medius* Kit., var. *ovatus* *Dipp.*).
- var. **microphyllus** *Beck* in *Fedde, Rep. Sp. Nov.* **17**, 451 (1921).
- var. **monstruosus** *Mouillef.* l.c.
- var. **repens** *Druce* *Brit. Pl. List* 23 (1928) nom. nud.
- subforma **pubescens** (*Stev.*) *Hayek* *Prod. Fl. Pen. Balcan.* **1**, 609 (1925).
- var. **pumilus** *Loudon* *Hort. Brit.* 84 (1830) (var. *nanus* *Loudon* *Arb. et Frut. Brit.* **2**, 496 (1838)).
- subforma **scaberulus** *Beck* ex *Hayek* *Prod. Fl. Pen. Balcan* **1**, 609 (1925).
- var. **typicum** *Max.* in *Bull. Acad. Imp. Sci., St. Petersburg.* **27**, 449 (1881) (var. *genuinus* *Rouy et Fouc.* *Fl. France* **4**, 159 (1897), var. *multiflorus* *Opiz* ex *Rouy et Fouc.* l.c., f. *typicus* *Busch* l.c.).
- f. **variegatus** *Dipp.* *Handb. Laubholz.* **2**, 487 (1892) (var. *acubae-folius* *Bean* l.c., ? var. *aureo-variegatus* *Bean* l.c.).
21. **E. hamiltonianus** *Wall.* in *Roxb. Fl. Ind. ed. Carey* **2**, 403 (1824) (*E. sieboldianus* *Blume*, *E. europaeus* *Forbes et Hemsl.* (non L.) in *Journ. Linn. Soc.* **23**, 121 (1886), *E. europaeus* L. var. *hamiltonianus* (*Wall.*) *Max.* in *Bull. Imp. Acad. Sci. St. Petersburg.* **27**, 449 (1881), *E. rugosus* *Lévl.* teste *Loes.*, *E. atropurpureus* *Roxb.* (non *Jacq.*). Non *hamiltonianus* *Koehne* in *Mitt. Deutsch. Dendr. Gesell.* 104–111 (1920)). N. Asia, Himalaya, Assam (Khasia), China, Japan. Capsule described by *Wallich* as yellow.
- var. **hians** (*Koehne* in *Gartenfl.* 33 (1904)) stat. nov. Cult.
- var. **lanceifolius** *Loes.* in *Engl. Jahrb.* **30**, 462 (1902)) stat. nov. (*E. bodinieri* *Lévl.* teste *Loes.*). China.
- var. **maackii** (*Rupr.* in *Bull. Phys.-Matth. Acad. Petersburg.* **15**, 358 (1857)) *Komarov* in *Act. Hort. Petrop.* **22**, 710 (1904) (*E. maackii* *Rupr.*, *E. europaeus* L. var. *maackii* (*Rupr.*) *Regel* *Fl. Ussur.* 45 (1862), *E. coreanus* *Lévl.*, *E. darrisii* *Lévl.* teste *Loes.*, *E. vidalii* *Franch. et Sav.* var. *stenophyllus* *Koidz.* teste *Nakai* in *Bot. Mag. (Tokyo)* **40**, 574 (1926)). Ussuri, Amur, Manchuria, also Japan (teste *Nakai*).
- var. **maackii** f. **lanceolatus** *Rehd.* in *Journ. Arn. Arb.* **22**, 578 (1941).
- var. **nikoensis** (*Nakai* in *Bot. Mag. Tokyo* **40**, 492 (1926)) stat. nov. e descr. Japan.
- var. **semiexsertus** (*Koehne* in *Fedde Rep. Sp. Nov.* **8**, 54 (1910)) stat. nov. Japan.
- var. **yedoensis** (*Koehne* in *Gartenfl.* 31 (1904)) stat. nov.

- var. **yedoensis** f. **koehneanus** (Loes.) *stat. nov.* (pro var. Loes. ex Sargent Pl. Wils. **1**, 491 (1913) ; *E. vidalii* Franch. et Sav. var. *koehneanus* (Loes.) Koidzumi ex Chun in Sunyatsenia **2**, 72 (1934)). China (Hupeh, Shensi).
- var. **yedoensis** f. **calocarpus** Koehne in Mitt. Deutsch. Dendr. **111** (1910).
- ▲
22. **E. bungeanus** Max Prim. Fl. Amur. 470 (1859) (*E. micranthus* Bunge (non Don), *E. forbesii* Hance). Manchuria, Corea, China. Perhaps only a variety of *hamiltonianus*.
- f. **pendulus** Rehd. in Journ. Arn. Arb. **7**, 31 (1926).
- var. **semipersistens** (Rehd.) Schneid. Ill. Handb. Laubh. **2**, 177 (1912) (*E. hamiltonianus* var. *semipersistens* Rehd. ex Bailey Cycl. Am. Hort. **2**, 559 (1900) ; *E. semipersistens* (Rehd.) Sprague).
- var. **mongolicus** (Nakai) Kitagawa in Rep. Inst. Sci. Res., Manchoukou **3**, app. 1, 307 (1939) e descr. Manchuria.
23. **E. phellomanus** Loes. ex Diels in Engl. Bot. Jahrb. **29**, 444 (1900). China (Shensi, Szechwan, Kansu).
- The following species are probably in the *Lophocarpi* Series, but their position is uncertain :
24. **E. arakianus** Koidz. in Act. Phytotax et Geobot. **1**, 174 (1932) e descr. Japan.
25. **E. oukiakensis** Pamp. in Nuov. Giorn. Bot. Ital. **17**, 419 (1910) e descr. China (Hupeh).
26. **E. quelpaertensis** Nakai in Bot. Mag. Tokyo **28**, 307 (1914) e descr. Corea.
27. **E. rothschuhii** Loes. in Engl. Bot. Jahrb. **23**, 125 (1896) e descr. Nicaragua.
28. **E. sieboldianus** Blume Bijdr. 1147 (1825). Japan. The type at Leiden is *E. hamiltonianus* s.l. The two following varieties I have not seen.
- var. **sanguineus** Nakai in Bot. Mag. (Tokyo) **40**, 493 (1926) e descr. Japan.
- var. **sphaerocarpus** Nakai in Journ. Jap. Bot. **17**, 685 (1941) e descr.
29. **E. trapococcus** Nakai in Bot. Mag. (Tokyo) **28**, 307 (1914) e descr. Corea.
30. **E. vidalii** Franch. et Sav. Enum. Pl. Jap. **2**, 312 (1879) e descr. Japan.
- var. **stenophyllus** Koidz. in Bot. Mag. (Tokyo) **31**, 32 (1909) e descr. Japan. Nakai regards this variety as a synonym of *E. hamiltonianus* var. *maackii*.

KEY TO SERIES MYRIANTHI SER. NOV.

- A. Flowers 4-merous
- B. Leaves petiolate

- C. Leaves elliptic to ovate
- D. Leaves entire or slightly serrate towards apex
- E. Leaves up to 8 cm., not bullate
- F. Leaves reticulate above and below, petals subentire
- G. Leaves more abruptly acuminate, veins spreading ; petiole 4–10 mm. long ; capsule 8–12 mm. long
31. *chinensis* Lindl.
- GG. Leaves more gradually acuminate, veins very oblique ; petiole 5–20 cm. long ; capsule c. 5 mm. long
32. *microcarpus* Sprague
- FF. Leaves reticulate above, not so below ; petals shortly fimbriate
33. sp. nov. ? (*Poilane* 1573)
fimbriate
- EE. Leaves up to 16 cm. long, \pm bullate
39. *bullatus* Wall.
- DD. Leaves serrate
 - H. Calyx 1.5–2 mm. diam. ; leaves with veins impressed above ; infl. 3–30-fl.
*Leaves with veins prominent, conspicuous and reticulate below
68. *moultoni* Ridl.
 - **Leaves with main lateral veins subprominent, secondary veins sub-prominent or not prominent inconspicuous and not or very little reticulate below
62. *castaneifolius* Ridl.
- HH. Calyx 3–5 mm. diam. ; veins prominent above
 - I. Infl. 3–5-fl. ? ; capsule 12–20 mm. long
34. *chibai* Makino
 - II. Infl. 7–12-fl. ; capsule 7–11 mm. long
37. *uniflorus* Lévl.
- CC. Leaves lanceolate to oblong
 - J. Leaves large up to 16 cm. long
 - K. Leaves thick \pm bullate ; fls. 4–5 mm. diam across petals
 - L. Infl. 20 or more fl. (rarely 7-fl.) ; leaves subentire or slightly serrate
39. *bullatus* Wall.
 - LL. Infl. 7-fl. ; leaves serrate
62. *castaneifolius* Ridl.
 - KK. Leaves thin, not bullate ; fls. 8–11 mm. diam. across petals
16. *lawsonii* Clarke
 - JJ. Leaves smaller up to 13 cm. long, not bullate
 - M. Capsule cuneate to subrotundate at base, lobes angled or carinate ; basal $\frac{1}{4}$ of leaf subentire

N. Leaves crenate-dentate at least in upper half

O. Capsule angled ; leaves thick

P. Fls. 8–16 mm. diam. across petals ; leaves 6–13.6 (rarely 16) cm. long, 2–6.5 cm. wide ; peduncle stout

35. *myrianthus* Hemsl.

PP. Fls. 5–7 mm. diam.

Q. Fls. c. 5 mm. diam. ; leaves 3.7–8 cm. long, 0.7–2.5 cm. wide ; peduncle very slender

36. *cuspidatus* Loes.

QQ. Fls. c. 7 mm. diam. ; leaves 1.8–9.6 cm., 0.5–4.5 cm. wide ; peduncle stoutish

37. *uniflorus* Lévl.

QQQ. Fls. 6–7 mm. diam. ; leaves 6–10 cm. long, 2–3.5 cm. wide ; peduncle stoutish

104. *oblongifolius* Loes. et Rehd.

OO. Capsule \pm deeply lobed ; leaves thin

R. Capsule deeply lobed, 6–10 mm. long ; fls. 8–11 mm. diam.

S. Leaves lanceolate, elliptic or oblong

16. *lawsonii* C. B. Clarke

SS. Leaves linear or linear-lanceolate

16. *lawsonii* var. *salicifolius* (Loes.) stat. nov.

RR. Capsule \pm deeply lobed, 15–20 mm. long ; fls. unknown

38. *kachinensis* Prain.

NN. Leaves entire or subentire

T. Leaves up to 14 cm. long, thin ; capsule \pm deeply lobed

71. *subsulcatus* Prain.

TT. Leaves up to 8 cm. long, thick, capsule angled

31. *chinensis* Lindl.

MM. Capsule rounded to truncate at the base, lobes rounded ; leaves crenate-dentate almost to base

40. *viburnoides* Prain

BB. Leaves sessile, ovate

112. *sootepensis* Craib.

AA. Flowers 5-merous

U. Petals entire or shortly dentate

V. Petals with conspicuous black veins towards margin ; flowers 10–18 mm. diam.

42. *tingens* Wall.

VV. Petals without black veins

W. Leaves linear-lanceolate to oblong, not so markedly acuminate

- X. Fls. c. 12 mm. diam. across petals ; capsule 20–30 mm. long
41. *macrocarpus* Gamble
- XX. Fls. c. 5 mm. diam. across petals ; capsule 6–10 mm. long
43. *longifolius* Champ.
- WW. Leaves elliptic to ovate, acuminate or not
- Y. Leaves long acuminate (China, Indo-China, Malay Pens.)
- Z. Leaves smaller, up to c. 8 cm. and c. 3 cm. wide (rarely 12 cm. long, 4.3 cm. wide) ; infl. 2–9-fl.
- a. Veins on leaves not impressed above, leaves not bullate ; twigs \pm terete or 4-angled and 4-lineate
- *Fls. 7–14 mm. across petals, 4–6 mm. across sepals
- b. Petals green
- c. Leaves less markedly serrate, subentire in lower $\frac{1}{2}$ or $\frac{3}{4}$; capsule unknown
47. *rostratus* W. W. Sm.
- cc. Leaves more markedly serrate, serrate almost to base or lower $\frac{1}{4}$ only subentire ; capsule 7–14 mm. long
46. *forbesianus* Loes.
- bb. Petals purple. Leaves as in *E. rostratus* capsule 7–14 mm. long
44. *laxiflorus* Champ.
- **Fls. 5 mm. diam. across petals, 2–3 mm. across sepals
45. *acuminifolius* sp. nov.
- aa. Veins on leaves impressed above, leaves \pm bullate
- d. Fls. 10–13 mm. diam. across petals, disc 3–4 mm. diam. ; petioles 6–10 mm. long ; twigs 4-winged
66. *mengtseanus* Sprague
- dd. Fls. c. 7 mm. diam. across petals, disc. c. 2 mm. diam. ; petioles c. 5 mm. long ; twigs subterete or 4-angled
69. *rubescens* Pitard.
- ddd. Fls. 10–15 mm. diam. across petals, disc. c. 2 mm. diam. ; petioles 2–6 mm. long ; twigs 4-angled
70. *impressus* sp. nov.
- ZZ. Leaves larger up to 10.5–16.3 cm. long, 7.5–5 cm. wide ; infl. 1–20-fl.
- e. Infl. 1–3-fl., 1–4.5 cm. long ; leaves thick, elliptic-lanceolate, up to 10.5–3.5 cm. long, 5–1.3 cm. wide, capsule c. 2 cm. long
58. *rufulus* Ridl.
- ee. Infl. 10–20-fl., 2–12 cm. long ; capsule 1.5–3 cm. long
57. *wrayi* King.
- YY. Leaves not acuminate or shortly acuminate (India, Siam, Malay Pens., Australia)
- f. Infl. pedunculate
- g. Infl. 1–3-fl.
- h. Leaves small up to c. 7 cm. long, c. 4 cm. wide.

- j. Capsule obovoid to obcordate ; leaves revolute or flat at margin.
- k. Leaves ovate, margin revolute, infl. 1-3-fl. ; fl. c. 8 mm. diam.
 - 48. *revolutus* Wight.
- kk. Leaves elliptic or oblong, margin flat or sub-revolute at most ; infl. 3 or more fl. ; fl. 8-10 mm. diam.
 - 49. *crenulatus* Wall.
- jj. Capsule clavate, leaves flat at margin
 - 50. *thwaitesii* Wight.
- hh. Leaves large up to 10.5 cm. long, 7.5-5 cm. wide
 - 58. *rufulus* Ridl.
- gg. Infl. 7 or more fl.
 - l. Twigs terete
 - m. Leaves small up to c. 7 cm. long, 3 cm. wide, entire
 - 51. *dichotomus* Heyne
 - mm. Leaves larger up to 9-16 cm. long, crenate-serrate at least towards apex
 - n. Leaves crenate-serrate only towards apex
 - o. Petals white or greenish
 - p. Infl. c. 7-fl. ; capsule 1 cm. long, less tapering at base
 - q. Leaves 5.5-11 cm. long, 1.6-6.6 cm. wide
 - 59. *australianus* F. Muell.
 - qq. Leaves up to 16 cm. long, 7 cm. wide
 - 53. *glaber* Roxb.
 - pp. Infl. 10-20 fl., leaves 4-13 cm. long, 2-6 cm. wide ; capsule 1.5-3 cm. long
 - 57. *wrayi* Ridl.
 - oo. Petals purple
 - 54. *paniculatus* Wight.
 - nn. Leaves sharply serrate to base
 - 55. *serratifolius* Bedd.
 - ll. Twigs acutely 4-angled, almost winged
 - 56. *angulatus* Wight.
 - ff. Infl. subsessile, capsule clavate
 - 52. *walkerii* Wight.
- UU. Petals fimbriate
 - r. Leaves lanceolate to lanceolate-elliptic, petals purple in sicco
 - 60. *attenuatus* Wall.
 - rr. Leaves oblanceolate to ovate, petals whitish or greenish, rarely purple
 - 61. *cochinchinensis* Pierre

SER. 4. MYRIANTHI SER. NOV.

31. **E. chinensis** Lindl. in Trans. Hort. Soc. **6**, 74 (1826) (*E. nitidus* Benth. ; *E. punctatus* Wall. ; *E. lindleyi* K. Koch. ; *E. merilli* Wang et var. *longipetiolatus* Wang?). India (Bengal, cult.?), China (Kwantung, Hainan).
32. **E. microcarpus** (Oliv.) Sprague in Kew Bull. 35 (1908) (*E. aureovirens* Hand.-Mazz. e descr.) China (Hupeh, Shensi, Szechuan).
33. **E. sp. nov.?** Annam : Bana, 8.6.1920, Chevalier, coll. Poilane 1573. The leaves resemble those of *E. laxiflorus* Champ. Capsules unknown. Cited incorrectly as *E. chinensis* by Tardieu-Blot in Suppl. Fl. Gen. Ind.-Chine **1**, 792 (1948).
34. **E. chibai** Makino in Bot. Mag. (Tokyo) **27**, 69 (1913). Japan. The only specimen seen is "Unzen, prov. Hizen, Oct. 1926, S. Ikeda" (B.M.).
35. **E. myrianthus** Hemsl. in Kew Bull. 210 (1893) (*E. rosthornii* Loes. ; *E. sargentianus* Loes. et Rehd.), China (Kwantung, Hupeh, Szechwan, Kweichow, also Hunan and Kwangsi teste Wang in Contrib. Bot. Surv. N.W. China **1**, 35 (1939).
var. **tenuifolius** (Loes.) comb. nov. : Loes. ex Diels in Engl. Bot. Jahrb. **29**, 438 (1900). China (Szechwan).
var. **crassifolius** (Loes.) comb. nov. Loes. l.c. China (Szechwan).
36. **E. cuspidatus** Loes. in Notizbl. Bot. Gart. Berlin **3**, 77 (1900). Tonkin.
37. **E. uniflorus** Lévl. et Vaniot in Bull. Soc. Agric. Sci. Arts Sarthe repr. 5 (1904) (*E. blinii* Lévl. pp. teste Loes.). China (Fukien, Chekiang, Kweichow). Possibly the same species as *cuspidatus* Loes., but only the flowers of *cuspidatus* are known.
38. **E. kachinensis** Prain. in Journ. As. Soc. Beng. **73**, 193 (1904). Upper Burma (Kachin Hills).
39. **E. bullatus** Wall. Cat. n. 4299 et in Lodd. Bot. Cab. t. 1749 (1831). N. Assam.
40. **E. viburnoides** Prain l.c. 194 (*E. forrestii* Comb. ; *E. chenkangensis* C. W. Wang). Himalaya (Sikkim), China (Yunnan). This species is transitional between the *Myrianthi* and *Japonici* Series. The fruit are shown on "Yunnan : Mengtse, Henry 9414".
41. **E. macrocarpus** Gamble. ex Oliver in Hook. Icon. Pl. **18**, t. 1763 (1888). Himalaya (Sikkim).
42. **E. tingens** Wall. ex Roxb. Fl. Ind. ed. Carey **2**, 406 (1824). W. and E. Himalaya, China (Yunnan, Szechwan).
43. **E. longifolius** Champ. ex Benth. in Hook. Kew Journ. **3**, 332 (1851). China (Kwantung).
44. **E. laxiflorus** Champ. l.c. 333 (*E. pellucidifolius* Hayata). China (Kwantung), Formosa.

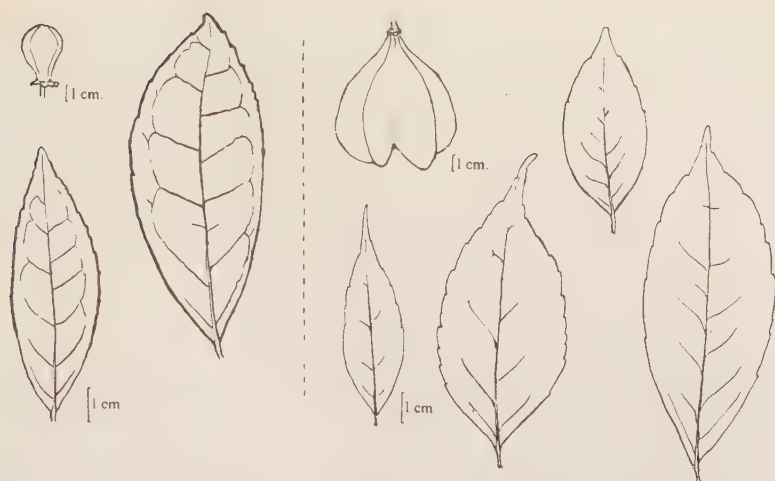


FIG. V. *Euonymus impressus* Blakelock (left) ; *E. acuminifolius* Blakelock (right).

45. **E. acuminifolius** sp. nov. ; ab *E. laxifloro* Champ. floribus minoribus 5 mm. (nec 7–14 mm.) diametro, foliis valde acuminatis tenuioribus differt. (Fig. V).

Frutex 1.5–3.6 m. altus. *Ramuli* tetragoni, 4-lineati vel 4-angulato-alati, deinde subteretes, laeves, glabri. *Folia* opposita, semper-virentia?, membranacea (subcoriacea in var.) glabra, elliptica, apice longe acuminata, basi cuneata, subtus pallidiora, margine remote dentato-crenata, subtus subrevoluta, nervis supra et subtus arcuato-anastomosantibus et prominentibus ; 3.8–11.3 cm. longa, 4.2–1.2 cm. lata ; petioli 2–6 mm. longi. *Inflorescentia* 1–61-fl., 0.7–7 (8.5 in var.) cm. longa ; pedunculus filiformibus 0.1–4 cm. longis, 0.25–1 mm. crassis ; pedicellis usque 1 cm. longis. *Flores* 5-meri, petalis 5 mm. diam., sepalis 2–3 mm. diam. ; sepala concava, margine minute dentata, 0.5–1 mm. longa, 1–1.5 mm. lata ; petala \pm orbiculata, rubra, purpurea vel viridia, margine irregulariter breviter dentata, c. 2 mm. longa, 2–2.5 mm. lata ; discus 1.5–2 mm. diam. ; antherae subsessiles, c. 0.75 mm. latae ; stigma disciforme, integrum vel subquinelobatum, subsessile, 0.5–0.75 mm. diam. *Capsula* obcordata, lobata, lobis 5–6 mm. latis, basi cuneata, apice retusa, 1.5–2 cm. longa, 1.2–1.8 mm. lata.

SUMATRA. Ophir District. Talamau, N.W. helling [slope], 950 m., bosch [forest], roode bloempjes [red flowers], 6.5.1917, *H. A. Bunnemeijer* 581 (type) ; same locality, 980 m., boschboompje [small forest tree], bloem groen [fls. green], frequentie algemeen [common], vernacular name pimpingan, 7.5.1917, do. 594 ; Ophir Distr. Boekit Kaboeng Loeboek Sihaping, 700 m., bosch [forest], bl. donker violet [dark violet], 22.6.1917, do. 1201 ; Goenoeng [Mountain] Talang, Padangsche Bovenlanden, W. coast, Larus Talang, bosch, 2100 m., 2.11.1918, do. 5389a (Herb. Buitenzorg).

var. **borneensis** var. nov. ; a typo foliis crassioribus minus acuminatis, inflorescentia longiore (1.5–8.5 cm. longa) differt.

BORNEO (Mt. Kinabalu). Tomis trail, slender shrub 12 ft., fl. dark red, 5.5.1932, *J. et M. S. Clemens* 30350 ; head of Colombon river, 9000 ft., mossy forest, scrubby, below 2000 ft. wall, slender shrub 6–8 ft., fl. dark maroon, fruit red, 11.7.1933, *do.* 33904 (type of var.) ; Colombon basin, 3500 ft., river gorge, fl. small purplish, 15.8.1933, *do.* 34478 (Herb. Buitenzorg).

The specimens from Borneo (the two on the right in fig. V) show thicker less acuminate leaves than those from Sumatra. In *Bünnemeijer* 581, 594 and 1201, the inflorescence is only up to 2.7 cm. long ; in *Bünnemeijer* 5389a it is up to 7 cm. long and in the Bornean specimens it is up to 8.5 cm. There is also some variation in how tetragonous and sharply angled are the twigs.

This species differs from *E. moultoni* Ridley in having pentamerous flowers and the veins prominent on the upper surface of the leaf.

46. ***E. forbesianus*** Loes. in Engl. Bot. Jahrb. **30**, 457 (1902) (*E. crosnieri* Lévl. et Van. ; *E. vaniotii* Lévl. p.p. ; *E. blinii* Lévl. p.p. teste Loes.). China (Yunnan), Tonkin (teste Merrill in Journ. Arn. Arb. **19**, 42 (1938).
47. ***E. rostratus*** W. W. Sm. in Notes Bot. Gard. Edinb. **10**, 36 (1917). China (Yunnan).
48. ***E. revolutus*** Wight. Illustr. **1**, 178 (1840). Ceylon.
49. ***E. crenulatus*** Wall. Cat. n. 4297 ; Wall. ex Wight et Arnott Prod. Fl. Pen. Ind. Or. 161 (1834). S. India.
50. ***E. thwaitesii*** Lawson ex Hook. f. Fl. Brit. Ind. **1**, 608 (1875). Ceylon.
51. ***E. dichotomus*** Heyne ex Wall. ex Roxb. Fl. Ind. ed Carey **2**, 410 (1824). S. India.
52. ***E. walkeri*** Wight Illustr. **1**, 178 (1840) (*E. zeylanicus* Moon). Ceylon. The clavate capsule on a peduncle up to 2 mm. long resembles that of the *Glomerati* Series. The flowers, however, are small, c. 4 mm. diam. (across petals), and the petals are entire or slightly dentate.
53. ***E. glaber*** Roxb. Fl. Ind. ed. Carey **2**, 403 (1824) (*E. carinatus* Craib. ; *E. ligustrinus* Craib. ; *E. serrulatus* Wall.). India, Malay Pens., Siam.
54. ***E. paniculatus*** Wight. ex Lawson in Hook. f. Fl. Brit. Ind. **1**, 609 (1875). S. India.
55. ***E. serratifolius*** Bedd. For. Man. Bot. t. 64 (1874) e descr. S. India (Nilgiris).
56. ***E. angulatus*** Wight Ic. t. 1053 (1846) (*E. pterocladus* Hohen. ; *E. acutangulatus* Wight ; *E. glaucus* Turcz. teste Lawson). S. India (Nilgiris).
57. ***E. wrayi*** King in Journ. As. Soc. Beng. **65**, 344 (1896). Malay Peninsula.

58. **E. rufulus** Ridley. in Journ. As. Soc. Straits **75**, 19 (1917). Malay Peninsula. Possibly only a variety of *E. urayi*.
59. **E. australianus** F. Muell. Fragm. **4**, 118 (1863-4). Australia (Queensland).
60. **E. attenuatus** Wall. ex Lawson ex Hook. f. Fl. Brit. Ind. **1**, 610 (1875). Assam (Khasia).
61. **E. cochinchinensis** Pierre Fl. For. Cochin. t. 309 (1891) (*Sphaerodiscus cochinchinensis* Nakai in Jap. Bot. Mag. **17**, 686 (1941)). Cochin-China, Cambodia, Malay Is.
- var. **tonkinensis** Pitard ex Lecomte Fl. Gen. Ind.-China. **1**, 874 (1911).

The following are probably synonyms or at most varieties of *E. cochinchinensis* :—

gibber, Hance. China (Kwantung).

miyakei Hayata e descr. Formosa. Stated by Nakai in Act. Phytotax. Geobot. **13**, 29 (1943) to be a synonym of *E. carnosus* Hemsl. but this view is not supported in Hayata's figure.

pahanguensis Ridley (*Glyptopetalum scortechinii* King). Malay Peninsula.

colonoides Craib. Siam.

similis Craib. Siam.

oliganthus Merrill. Philippine Is.

vivurnifolius Merrill p.p. (*E. philippinensis* Merrill) Philippine Is.

A specimen from "Dutch N.W. New Guinea : Manokoari, Jan. 1914, L. S. Gibbs 6182" probably belongs to the *cochinchinensis* group. This specimen shows flowers, but no fruit. Three specimens in the Buitenzorg Herbarium, showing fruit and flowers belong to this group, "Dutch New Guinea : Patema, 40 km. inward of Nabire, 300 m., 29.2.1940, 5.3.1940, Kanehira and Hatusima 11885, 12360 ; Bivak Prao, 40 km. inward of Nabire, 100 m., 12.3.1940, do. 12834".

62. **E. castaneifolius** Ridley in Kew Bull. 36 (1931). Borneo. Fruit is shown in two specimens from the Buitenzorg Herbarium. "Borneo : Ond. Afd. [subdivision] W. Koetai, near L. [?] Petah [k?], c. 700 m., 11.9.1925, F. H. Endert 3159 ; W. Koetai, near the Kemoel, c. 1200 m., 4.10.1925, do. 3827.

The capsule is obconic, 4-angulate, truncate or slightly retuse (sometimes oblique) at the apex, cuneate at the base, 10-16 mm. long, 7-12 mm. wide. In sicco the surface is markedly reticulate-rugose as though the outer layer had been fleshy and wrinkled on drying ; the rugosity does not alter on boiling. The aril covers the basal $\frac{1}{3}$ of the seed. The fruit is green, yellow-green then red and the petals white (from field notes).

The leaves in both specimens are shorter wider and less strongly serrate than in the type "Sarawak : Kuching, Haviland 827". In Endert 3159 the leaves are elliptic, 5-9.5 cm. long, 4.2 cm. wide,

and connect *E. castaneifolius* and *E. moultoni* which may only be varieties of one species.

The following species are probably in this Series, but their position is uncertain.

63. ***E. esquirolii*** Lév. in Fedde Repert **13**, 26 (1914) e descr. China (Kweichow).
64. ***E. feddei*** Lév. l.c. 260. China (Kweichow). Leaves and young infl. only seen.
65. ***E. incertus*** Pitard ex Lecomte Fl. Gén. Indo-Chine **1**, 874 (1912) e descr. Tonkin.
66. ***E. mengtseanus*** (Loes.) Sprague in Kew Bull. 35 (1908). China (Yunnan).
67. ***E. mitratus*** Pierre Fl. For. Cochinch. sub t. 308 (1894) e descr. Cambodia.
68. ***E. moultoni*** Ridley in Kew Bull. 36 (1931). Borneo. Fruit unknown.
69. ***E. rubescens*** Pitard ex Lecomte Fl. Gen. Indo-Chine **1**, 875 (1912). Tonkin.
70. ***E. impressus*** sp. nov. ; ab *E. cochinchinensi* Pierre, ramulis 4-angulatis, foliis bullatis, pedunculis pedicellisque gracilibus, petalis irregulariter dentatis, ab *E. castaneifolio* Ridl. floribus 5-merous multo majoribus petalis 4-6 mm. longis (haud 1 mm. longis), foliis minoribus 5-6 (nec 9-10)-nervatis differt. (Fig. V).

Habitus? *Ramuli* 4-angulati, laeves, glabri. *Folia* opposita, sempervirentia?, coriacea, bullata, glabra, anguste elliptica vel lanceolata, apice acuminata, basi cuneata, margine remote crenato-serrata basin versus integra, nervis utroque latere costae 5-6 supra impressis arcuatis subtus prominentibus, 6-10.5 cm. longa, 1.6-4 cm. lata ; petioli 2-6 mm. longi. *Inflorescentia* 2-7-fl., 3.5-6 cm. longa, pedunculis et pedicellis gracilibus usque 0.75 mm. crassis. *Flores* 5-meri : corolla 1-1.5 cm. diametro ; sepala concava, margine dentata, 1-1.5 mm. longa, 1.5-2.5 mm. lata ; petala obovata vel orbiculata, margine irregulariter breviter dentata, 4-6 mm. longa, 3-6 mm. lata ; discus c. 2 mm. latus ; antherae subsessiles, c. 1 mm. latae ; stigma subsessile. *Capsula* immatura, obovata, lobata, apice rotundata.

CELEBES. Goenoeng Keppe, Aug. 1933, *Rachmat* (Van Vuuren Expedt.) 544 (type, Herb. Buitenzorg).

71. ***E. subsulcatus*** Prain in Journ. As. Soc. Beng. **73**, 194 (1904). Burma (Tenasserim). Only known from the type gathering (Herb. Calcutta), which shows two dehiscent capsules.

KEY TO GLOMERATI SERIES.

- A. Peduncles 1-fl., fascicled, in pairs or solitary in leaf axil ; leaves generally flat

- B. Leaves entire or somewhat crenate-dentate towards apex ; reticulations of veins generally less prominent below
- C. Leaves thinly coriaceous ; fls. fascicled, in pairs or solitary ; peduncles 4–22.5 mm. long
- D. Capsules cuneate at base, 5-merous (rarely 4- or 6-merous) leaves entire or somewhat crenate-dentate towards apex
- E. Capsules up to 1–2.8 cm. long ; angles and apex various
- F. Capsules clavate, 1.2–2.8 cm. long
72. *javanicus* Blume var. *genuinus* Koord. et Val.
- FF. Capsules obcordate, 1–2 cm. long
72. *javanicus* var. *sphaerocarpus* Hasskl.
- EE. Capsules up to 2.5–3 cm. long ; angles wide-winged ; apex deeply retuse
72. *javanicus* var. *elmeri* (Merr.) stat. nov.
- DD. Capsules rounded-cuneate at base, 4–5-merous ; leaves entire
72. *javanicus* var. *timorensis* (Zipp.) Miq.
- CC. Leaves thickly coriaceous ; fls. in pairs ; peduncles 3–5 mm. long
72. *javanicus* var. *coriaceus* (Ridl.) stat. nov.
- BB. Older leaves crenate-dentate in upper half (c. 1 cm. between crenations) ; reticulations of veins more prominent below
73. *sumatranus* Miq.
- AA. Peduncles 1–3-fl. ; veins often impressed above on leaves
- G. Pedicels 4–10 mm. long ; peduncle unbranched or with secondary axes up to 1 mm. long
74. *indicus* Heyne
- GG. Pedicels 7–10 mm. long ; peduncle unbranched or with secondary axes up to 6 mm. long
75. *micropetalus* Ridl.

SERIES 5. GLOMERATI (LOES.) STAT. NOV.

72. **E. javanicus** Blume Bijdr. 1146 (1826) (*E. bancanus* Miq., *E. horsfieldii* Turcz., *E. javanicus* var. *talungensis* Pierre Fl. For. Cochinch. **4**, pl. 308 (1891)). Burma, Malay Penins., Indo-China, Malay Is., Philippine Is.
var. **genuinus** Koord. et Val. Bijdr. Booms. Java **7**, 90 (1900).
(var. *conocarpus* Hasskl. in Tijdschr. Nat. Gesch. **10**, 26 (1843)).
var. **sphaerocarpus** Hasskl. Pl. Rar. Jav. 230 (1848). Java.
var. **timorensis** (Zipp.) Miq. Fl. Ind. Bat. **1**, II, 589 (1859). Timor.
var. **elmeri** (Merr.) stat. nov. (*E. alatus* Elmer). Philippine Is.
var. **coriaceus** (Ridl.) stat. nov. Malay Penins.
73. **E. sumatranus** Miq. Fl. Ind. Bat. **1**, II, 589 (1859). Sumatra. Flowers unknown ; perhaps only a var. of *E. javanicus*.
74. **E. indicus** Heyne ex Roxb. Fl. Ind. ed. Carey **2**, 409 (1924) (*E. goughii* Wight). India (Bombay, Nilgiris).

75. **E. micropetalus** Ridley Fl. Mal. Penins. **5**, 299 (1929). Malay Peninsula.

KEY TO SERIES 6. PSEUDOVYENOMI (NAKAI) STAT. NOV.

- A. Twigs verrucose, leaves large 1·8–10 cm. long, 1·1–2·7 cm. wide
- B. Leaves glabrous below or sparsely hairy on veins at most, acute sometimes acuminate at apex
- C. Infl. 1–7 fl., twigs green, warts black or brown
- (i) Twigs medium-sized ; leaves pubescent below, elliptic, apex shortly acuminate
76. *verrucosus* Scop. var. *genuinus* Syr.
- (ii) Twigs much elongated ; leaves lanceolate to wide lanceolate, apex long acuminate
76. *verrucosus* Scop. var. *angustifolius* Syr.
- (iii) Leaves glabrous below
76. *verrucosus* var. *laevifolius* Beck.
- CC. Infl. 3–10-fl., twigs subverrucose, grey
76. *verrucosus* Scop. var. *tchefouensis* Deb.
- BB. Leaves densely pubescent below
- D. Leaves sparsely pubescent above
- E. Infl. 1–3-fl., central pedicel of infl. very short, pedicel jointed above the middle ; petiole 1–2 mm. long ; leaves acuminate
77. *pauciflorus* Max
- EE. Infl. 2–6-fl., central pedicel of infl. little shorter than the lateral ones ; petiole 3–5 mm. long. ; leaves acute
77. *pauciflorus* var. *chinensis* (Max) Rehd.
- DD. Leaves glabrous above, pedicel jointed at or below the middle, petiole 4–5 mm. long, leaves acuminate
78. *oligospermus* Ohwi
- AA. Twigs not verrucose ; leaves small up to 5 cm. long
- F. Leaves ovate to lanceolate ; peduncle 6–25 mm. long
- G. Leaves acute, less deeply crenate-serrate
*Leaves ovate or elliptic, acuminate, 1·8–6 cm. long, 1·3–3 cm. wide ; petiole 1–4 mm. long ; fls. 7–8 mm. diam. across, red petals
79. *melananthus* Franch. et Sav.
- **Leaves lanceolate, acute ; other characters various
- H. Petals red, flowers 5–6 mm. diam. across petals ; peduncle more slender
- I. Leaves 0·5–5 cm. long, 0·2–1·4 cm. wide, petiole 2–4 mm. long (rarely 1 mm. long)
80. *semenovii* Reg. et Herd.
- II. Leaves 0·6–3·6 cm. long, 0·4–1·5 cm. wide ; petiole 1–2 mm. long
81. *przewalskii* Max
- HH. Petals green or white (in sicco), flowers c. 7 mm. diam. ; peduncle stouter
82. *tibeticus* W. W. Sm.

GG. Leaves obtuse, more deeply crenate-serrate

J. Leaves 1.5–2.5 cm. long, 0.8–0.11 cm. wide, thinner, not reticulate veined above

83. *saxicolus* Loes. et Rehd.

JJ. Leaves 3–4.5 cm. long, 1.3–2.4 cm. wide, thicker, reticulate veined above

84. *crenatus* Wang

FF. Leaves linear-lanceolate, peduncle 1–5 mm. long

K. Leaves, petioles and twigs pubescent

85. *nanoides* Loes.

KK. Leaves, petioles and twigs glabrous

86. *oresbius* Loes.

SERIES 6. PSEUDOVYENOMI SER. NOV.

76. **E. verrucosus** Scop. Fl. Carn. ed. 2, 1, 166 (1772) (*E. europaeus* var. *leprosa* L. fil. Suppl. Pl. 154 (1781); *E. pannonicus* Scop. ex C. F. Ludwig Neu Wilde Baumz. 19 (1783) pro syn. t. Rehder; *E. voitii* Graebn. et fil. in Beitr. Naturdenkmappfl. 10, 225 (1924/5) t. Loes. (1942)). E. Europe, Caucasus, Asia Minor, also N. Perisa (teste Bornm. in Verh. K.K. zoo.-bot. Ges. Wien 60, 95 (1910)).
var. **angustifolius** Syr. in Bull. Soc. Nat. Mosc. Sect. Biol. 40, 48 (1931) e descr. Russia (Moscow).
var. **genuinus** Syr. l.c. e descr. Russia (Moscow).
f. **laevifolia** Beck. in Ann. Nat. Hofmus Wien 2, 87 (1887) e descr. Bosnia (Sarajevo).
var. **tfchefouensis** Deb. e descr. Rehder in Journ. Arn. Arb. 7, 204 (1926) regards this as possibly related to *kiautschovicus* Loes. and not to *verrucosus*. China (Shantung).
f. **transsilvanicus** Karpati in Borbasia 1, 100–105 (1939) descr. non vidi; Biol. Abs. 18, 22484.
77. **E. pauciflorus** Max. Prim. Fl. Amur. 74 (1859). Manchuria, Korea.
var. **chinensis** (Max.) Rehd. in Journ. Arn. Arb. 7, 204 (1926) (*E. verrucosus* var. *chinensis* Max. in Mem. Acad. Sci. St. Petersburg. 74 (1859)). China (Shensi). Winter buds sometimes 5.5 mm. long (Korea, Wilson 9474).
78. **E. oligospermus** Ohwi in Act. Phytotax. et Geobot. 5, 185 (1936) e descr. (*E. pauciflorus* var. *japonicus* Koidz. ex Ohwi in Act. Phyt. et Geobot., Kyoto 5, 155 (1936)). Japan.
79. **E. melananthus** Franch. et Sav. Enum. Pl. Jap. 2, 312 (1879). Placed here, rather than in Ser. *Melanocarya*, as the bud veneration is involute. Fruit unknown to me and its affinities doubtful.
80. **E. semenovii** Regel et Herder in Bull. Soc. Nat. Mosc. 29, 557 (1866). Turkestan, China (Szechwan).
81. **E. przewalskii** Max. in Bull. Acad. Petersburg. 27, 451 (1881). China (Kansu). Very close to and possibly only a synonym of *E. semenovii*.

82. **E. tibeticus** W. W. Sm. in Rec. Bot. Surv. Ind. **4**, 264 (1911). E. Himalaya (Sikkim, S.E. Tibet).
83. **E. saxicolus** Loes. et Rehd. in Sargent Pl. Wilson **1**, 491 (1913). China (Szechwan).
84. **E. crenatus** Wang in Contrib. Bot. Surv. N.W. China **1**, 31 (1939) e descr. China (Yunnan). Perhaps not distinct from *E. saxicolus*. Kingdon Ward 7727 from Naga Hills, Assam seems intermediate between the two species.
85. **E. nanoides** Loes. et Rehd. l.c. 492. China (Szechwan).
86. **E. oresbius** W. W. Sm. in Notes R. B. Gard. Edinb. **10**, 34 (1917) (*E. pachycladus* Hd.-Mzz. e descr. orig. et in Symb. Sin. VII, 662 (1929-33)). China (Szechwan).

KEY TO SERIES 7. NANEVONYMI (LOES.) STAT. NOV.

- A. Leaves opposite ; petals green ; flower 4-merous
87. *lichiangensis* W. W. Sm.
- AA. Leaves alternate or in whorls of 3 ; fls. 4- or 5-merous
- B. Leaves up to 3.5 cm. long
- C. Petals yellow ; fls. 8-10 mm. diam., 4-merous
88. *ternifolius* Hd.-Mzz.
- CC. Petals red ; fls. c. 6 mm. diam., 4-merous
89. *nanus* M.B.
- BB. Leaves 6-10 cm. long, 1.5-2 cm. wide ; petals white or yellow ; 5-merous
95. *linearifolius* Franch.
- BBB. Leaves 4-5 cm. long, 1-1.5 cm. wide ; petals pale yellow ; 4-merous
90. *platycline* Ohwi

SERIES 7. NANEVONYMI (LOES.) STAT. NOV.

87. **E. lichiangensis** W. W. Sm. in Notes R. Bot. Gard. Edinb. **10**, 33 (1917). China (Yunnan). Very near *E. oresbius* W. W. Sm. differing only in being evergreen, and in having somewhat longer and narrower leaves. The last mentioned character may not be constant.
88. **E. ternifolius** Hd.-Mzz. Symb. Sin. VII, 659 (1933) e descr. China (Szechwan).
89. **E. nanus** M.B. Fl. Taur. Cauc. **3**, 160 (1819) (*E. lilieurii* Hort., *E. linifolius* Hort. ex Dipp., *E. rosmarinifolius* Vis., *E. koopmannii* Lauche, *E. nanus* var. *turkestanicus* Dieck. f. Nachtr. I Haupt-Ver. Baum. Zöschén 10 (1887), *E. nanus* var. *koopmannii* (Lauche) Beissn., Schelle et Zabel in Handb. Laubh.-Bennen 294 (1903)). E. Europe (Russia, Roumania, Bucovina), Caucasus, Asia Minor, Turkestan, Mongolia, China (Kansu, Shensi). According to Stapf (Bot. Mag. 9308, 1933) the description of the flowers of *E. koopmannii* as pentamerous is probably incorrect. A specimen

from "Turkey : Vilayet Denizli (Caria), Boz Dag above Geyran yaila, near Acipayam, 5000-5500 ft., shady rocks, 16.7.1947, P. H. Davis 13427" should be mentioned here ; the vegetative parts match those of *E. nanus*, but unfortunately there are neither flowers nor fruits, so the record remains a doubtful one.

90. **E. platycline** *Ohwi* in Act. Phytotax. et Geobot. **5**, 186 (1936) e descr. Formosa. Capsule unknown.

KEY TO SERIES 8. GRANDIFLORI SER. NOV.

- A. Fls. 4-merous, leaves generally opposite
- B. Leaves usually finely crenate-serrate
 - (a) ovate, obovate or elliptic, or oblong-elliptic leaves
 - 91. *grandiflorus* Wall.
 - (b) lanceolate, lanceolate oblong leaves
 - 91. *grandiflorus* f. *salicifolius* Stapf et Ballard.
 - BB. Leaves more coarsely crenate-serrate, wide oval, suborbicular or obovate leaves
 - 92. *carnosus* Hemsl.
- AA. Fls. 5-merous
 - C. Leaves not spiny, alternate
 - D. Leaves lanceolate to wide ovate
 - E. Leaves lanceolate, shrub 3-4 ft., capsule unknown
 - 93. *yunnanensis* Franch.
 - EE. Leaves oval to wide obovate, tree 9-12 m., fls. unknown
 - 94. *decorus* W. W. Sm.
 - DD. Leaves linear, 6-10 cm. long, capsule unknown
 - 95. *linearifolius* Franch.
 - CC. Leaves with a spiny margin, opposite ; capsule unknown
 - 96. *acanthodontus* Loes.

SERIES 8. GRANDIFLORI SER. NOV.

91. **E. grandiflorus** Wall. ex Roxb. Fl. Ind. ed. Carey **2**, 404 (1924) (*Pragmotessera grandifolia* Pierre ; *E. mairei* Lévl. teste Loes. ; *Lophopetalum grandiflorum* Arnott in Ann. Nat. Hist. **3**, 151 (1839)). The leaves are deciduous, although Loesener in Engl. Bot. Jahrb. **30**, 452 (1902) describes it as evergreen. There are 4-10 ovules in each loculus. W. and E. Himalaya, Assam (Khasia), N. Burma, China (Chekiang, Kiangsu?, Hupeh, Anwhei, Szechwan, Yunnan).
- f. **salicifolius** Stapf et Ballard in Bot. Mag. 9183 (1927) (var. *angustifolius* Wang in Chinese Journ. Bot. **1**, 49 (1936) ; Contrib. Bot. Surv. N.W. China **1**, 37 (1939)). Distr. as for species ?
92. **E. carnosus** Hemsl. in Journ. Linn. Soc. **23**, 118 (1886) (*E. tanakae* Max., *E. batakensis* Hayata e descr.). Formosa, Liukiu Is., Bonin Is., S. Japan. Leaves deciduous (evergreen t. Max.) ; 4-5, generally 4, ovules in each loculus.

93. **E. yunnanensis** Franch. in Bull. Soc. Bot. Fr. **33**, 454 (1886).
Leaves evergreen or semipersistent. Capsule unknown. China (Yunnan).
94. **E. decorus** W. W. Sm. in Notes R. Bot. Gard. Edinb. **10**, 32 (1917).
Leaves evergreen. Possibly fruiting material of *E. yunnanensis*. China (Yunnan).
95. **E. linearifolius** Franch. in Bull. Soc. Bot. Fr. **33**, 455 (1886).
Leaves evergreen. Capsule unknown. China (Yunnan).
- E. pinchuanensis** Loes. in Pflanzenfam. **20B**, 121 (1942) e descr.
This species is compared with *E. linearifolius* Franch. and described as "mit linear elliptischen, ganzrandigen Blättern, beide ebenfalls in Zentralchina".

Possibly in this series :

96. **E. acanthodontus** Loes. in Notizbl. Bot. Gart. Berlin **13**, 579 (1937) e descr. Capsule unknown. Madagascar.

KEY TO SERIES 9. FUSIFORMES SER. NOV.

- A. Leaves shortly acuminate, capsule 4-merous, 4 cm. long, petals subentire
97. *fusiformis* R. N. Parker.
- AA. Leaves rotundate to obtuse, capsule 5-merous, 1.5–2.3 cm. long, petals fimbriate
98. *recurvans* Miq.

SERIES 9. FUSIFORMES SER. NOV.

97. **E. fusiformis** R. N. Parker in Fedde Repert. **29**, 104 (1931).
Burma (Mergui). Two ovules in each loculus.
98. **E. recurvans** Miq. Fl. Ind. Bat. Suppl. 513 (1860). Sumatra :
Padang, Mt. Singalan, June–July 1878, Beccari 71, 263 (Herb. Kew.) belong to this species. The type has been seen while on loan from Leiden.

KEY TO SERIES 10. JAPONICI SER. NOV.

- A. Infl. a cyme solitary in axil of a leaf (Asia)
- B. Leaves spiny
- C. Leaves petiolate
99. *ilicifolium* Franch.
- CC. Leaves sessile
100. *aquifolium* Loes. et Rehd.
- BB. Leaves serrate or crenate, not spiny
- D. Leaves petiolate
- E. Leaves ovate or obovate
- F. Leaves obtuse, rotundate or acute, rarely slightly acuminate
*Petals ovate or suborbicular
- G. Erect shrubs up to 3–8 m. ; branches not rooting ; fls.
5–10 mm. diam.

- H. Evergreen, thick leaves ; generally contracted infl. (secondary axes c. 10 mm. long). Flowers May-July
- (i) Fls. 6-10 mm. diam. across petals ; leaves c. 3-7 cm. long in typical form (see separate key for vars.)
107. *japonicus* L.f.
- (ii) Fls. c. 5-6 mm. diam. across petals ; leaves 2-4.5 cm. long
108. *boninensis* Koidz.
- HH. Semipersistent, thin leaves ; spreading infl. (secondary axes up to 16 mm. long). Flowers Aug. to Oct.
109. *kiautschovicus* Loes.
- GG. Low (up to c. 1.5 cm. high) or climbing shrubs ; branches rooting ; fls. 4-8 mm. diam. across petals
- J. Winter buds ovoid, 3-7 mm. long, acute ; fls. 4-6 mm. diam. across petals
- K. Leaves up to 8.5 cm. long ; stouter peduncles and pedicels ; petals thicker and stiffer, subentire ; filaments c. 1-2 mm. long (see separate key for vars.)
106. *fortunei* (Turcz.) Hd.-Mzz.
- KK. Leaves often up to 9 cm. long occasionally up to 16.5 cm. long ; slender peduncles and pedicels ; petals thinner, shortly and irregularly sinuate-dentate ; filaments up to 1 mm. long
- (i) Leaves smaller
105. *vagans* Wall.
- (ii) Leaves 7.7-16.5 cm. long, 3-8 cm. wide
105. *vagans* subsp. *macrophyllus* K., K., Das et Purk.
- JJ. Winter buds conic, very acute, 7-10 mm. long ; fls. c. 8 mm. diam. across petals
114. *hederaceus* Champ.
- **Petals oblanceolate**
115. *tonkinensis* Loes.
- FF. Leaves markedly acuminate
103. *flavescens* Loes.
- EE. Leaves oblong, lanceolate or linear-lanceolate
- N. Capsule pale or dark brown *in sicco* (where known) ; leaves reticulate or not above
- O. Peduncle stout, 3-5 cm. long ; twigs tuberculate
115. *tonkinensis* Loes.
- OO. Peduncle slender, up to 3 cm. long ; twigs tuberculate or not
- Q. Reticulations on leaf as wide as long, main lateral veins not recurved ; leaves lanceolate, elliptic to ovate
- R. Petiole over 4 mm. long, up to 12 mm. long
- S. Leaves not or obscurely reticulate above, apex acute obtuse or rarely acuminate

- (i) Leaves smaller
105. *vagans* Wall.
- (ii) Leaves 7.7–16.5 cm. long, 3–8 cm. wide
105. *vagans* subsp. *macrophyllus* K., K., Das et Purk.
- SS. Leaves finely and conspicuously reticulate above, acuminate
104. *oblongifolius* Loes. et Rehd.
- RR. Petiole up to 4 mm. long
110. *orgyalis* W. W. Sm.
- QQ. Reticulations on leaf twice or more as long as wide, main lateral veins recurved; leaves linear-lanceolate to elliptic
113. *venosus* Hemsl.
- NN. Capsule greyish-green, green, or greenish brown in *sicco*; leaves conspicuously reticulate above
T. Infl. up to 15-fl.; fls. 4–9 mm. diam. across petals
U. Main lateral veins sub-prominent, leaves not bullate, more closely crenate-serrate; twigs smooth. Capsule unknown
104. *oblongifolius* Loes. et Rehd.
- UU. Main lateral veins sharply prominent, leaves \pm bullate, less closely crenate-serrate; twigs conspicuously tuberculate
101. *theifolius* Wall.
- TT. Infl. 15–30 (or more)-fl., rarely 7-fl.; fls. 8–9 mm. diam. across petals
102. *tengyuehensis* W. W. Sm.
- DD. Leaves sessile or subsessile (petiole up to 2.5 mm. long)
(i) Leaves oblong lanceolate
111. *griffithii* Kurz.
(ii) Leaves ovate to subrotundate
112. *sootepensis* Craib
(iii) Leaves elliptic-oblong to oblong-obovate, leaves more sharply serrate
119. *chloranthoides* Yang.
- AA. Infl. a corymb of 2–3 pairs of cymes. Corymb terminal or axillary (Mexico)
116. *corymbosus* Sprague et Bullock.
- Key to varieties of *E. fortunei* (Turcz.) Hand.-Mazz. (*E. radicans* Miq. var. *acutus* Rehd.) (mainly after Rehder Man. 1940, p. 559).
- A. Leaves over 2 cm. long, not papillate
B. Leaves with veins slightly raised above, distinctly veined beneath (in *sicco*). Leaves elliptic or elliptic ovate rarely obovate, 2.5–6 cm. long, acute or acuminate. Branches rooting.
C. Leaves green
106. *fortunei* (Turcz.) Hd.-Mzz.

CC. Annotine leaves glaucous above

var. *alticola* Hd.-Mzz.

CCC. Leaves changing in autumn to dark purple above and light purple below

f. *coloratus* (Rehd.) Rehd.

BB. Leaves of thicker texture, veins obsolete (in sicco)

D. Leaves ovate to elliptic

E. Leaves ovate or broad elliptic, usually c. 1–4 cm. long, acute or \pm obtuse, more distinctly serrate than type, trailing or climbing habit

F. Leaves green, branches rooting

var. *radicans* (Sieb.) Rehd.

FF. Leaves variegated white or yellow

G. Leaves variegated with white along the veins

f. *reticulatus* (Reg.) Rehd.

GG. Leaves variegated and margined white or yellow or with pink on the margin. Branches rooting (a group of variable and inconstant forms)

f. *gracilis* (Reg.) Rehd.

EE. Leaves elliptic or elliptic oblong, 3–5 cm. long, acutish lustrous. Spreading shrub or somewhat climbing if supported. Branches not rooting or only occasionally rooting. Free fruiting in cultivation.

H. Leaves green

f. *carrierei* (Vauvel) Rehd.

HH. Leaves margined white

“Silver Queen”

DD. Leaves broad-elliptic to nearly suborbicular. Leaves 2.5–4 cm. long, acute or \pm obtuse, crenate-serrate, dull green, thickish. Spreading shrub to 1.5 m. or climbing if supported. Branches not rooting or only occasionally rooting. Free fruiting in cultivation

var. *vegetus* (Rehd.) Rehd.

AA. Leaves 0.6–1.5 cm. long, minutely papillate; low usually creeping shrub, sterile

f. *minimus* (Simon-Louis) Rehd.

The following varieties I have not seen. As they cannot be fitted into the above key, the original descriptions of them are given here.

var. *angustifolius* (Graebner) Nakai. “Rami et folia glaberrima. Folia oblongo-lanceolata vel oblongo-oblancheolata 30–70 mm. longa 10–26 mm. lata crenato-serrata”.

var. *villosus* Nakai. “Rami juveniles, petioli et costa foliorum infra dense patente rigide villosi. Folis elliptica vel oblonga”.

var. *villifolius* Nakai. “Folia alia oblongo-oblancheolata 22–32 mm. longa 7–12 mm. lata, alia oblancheolata 35–41 mm. longa 9–11 mm. lata. Rami hornotini petioli et costa infra scabro-villosi”.

var. *viridis* Regel. "Blätter, oval-elliptisch, grün." Perhaps the typical form.

Key to varieties and forms of *E. japonicus* L.f.

A. Erect spreading shrubs

B. Leaves dark green

- (1) Leaves obovate to narrow elliptic, 3–7 cm. long
107. *japonicus* L.f.

[Leaves obovate to narrow elliptic, 2–4.5 cm. long
108. *E. boninensis* Koidz.]

- (2) Leaves elliptic, 5–7.5 cm. long
japonicus L.f.
var. *macrophyllus* Regel

- (3) Leaves narrow oblong to lanceolate-oblong, 1–2.5 cm. long
var. *microphyllus* Jacq.

- (4) Leaves crisped
var. *calamistratus* Mouillef.

- (5) Leaves oblanceolate 4.5–8 cm. long, branches often pendulous
var. *longifolius* Nakai

- (6) Leaves oblong rarely obovate 4–6.5 cm., veins much impressed above
var. *rugosus* Nakai

BB. Leaves variegated

D. Leaves green and white

- (7) Leaves ovate-elliptic, green edged and marked with white
var. *argenteo-variegatus* Reg.

- (8) Leaves green with rather a narrow white margin
var. *albo-marginatus* T. Moore.

- (9) Leaves ovate, flat, edged and variegated with white
var. *latifolius* Regel

- (10) Leaves crisped, edged and variegated with white
var. *crispus* Regel

- (11) Leaves variegated with white, the size of those of var. *microphyllus*

f. *pulchellus* Dippel.

DD. Leaves partly yellow

C. Leaves green and yellow

- (12) Leaves edged with yellow
var. *aureo-marginatus* Regel

- (13) Leaves large, bright green, variegated green and yellow in the centre
var. *viridi-variegatus* Regel

- (14) Leaves with yellow or white spots
f. *punctatus* Dippel.

- (15) Leaves blotched golden yellow
var. *aureo-variegatus* Regel

- (16) Leaves blotched sulphur yellow
var. *sulfureo-variegatus* Regel
- (17) Leaves bright yellow at centre with only a marginal line of dark green
var. *aureus* Carrière
- (18) Leaves ovate, dark green, yellow in centre especially towards base
var. *ovatus* Carrière
- CC. (19) Leaves blotched greenish-yellow and rose
f. *tricolor* Dippel.
- CCC. Leaves yellow
(20) Leaves yellow-white
f. *flavescens* Dippel.
- (21) Leaves bright yellow
f. *sulphureus* André.
- AA. Shrubs of columnar habit
(23) Strictly upright columnar and very compact habit ; leaves crowded
var. *pyramidatus* Carr.
- (24) Less compact ; leaves narrow elliptic
var. *fastigiatus* Carr.

SERIES 10. JAPONICI SER. NOV.

99. **E. ilicifolium** Franch. in Bull. Soc. Bot. Fr. **33**, 453 (1886)
(*Pragmotessera ilicifolia* Pierre). China (Yunnan).
100. **E. aquifolium** Loes. et Rehd. in Sargent Pl. Wilson **1**, 484 (1913).
China (Szechwan). Capsules more lobed than in the rest of this Series.
101. **E. theifolius** Wall. ex Lawson ex Hook. f. Fl. Br. Ind. **1**, 612 (1875). (*Pragmotessera theifolia* Pierre ; *E. blinii* Lévl. p.p. teste Loes.). Himalaya (Sikkim), Assam.
102. **E. tengyuehensis** W. W. Sm. in Notes R. Bot. Gard. Edinb. **10**, 36 (1917). China (Yunnan).
103. **E. flavescens** Loes. ex Diels in Engl. Jahrb. **29**, 437 (1900) (*E. nantoënsis* Loes.). China (Hupeh). Also from Szechwan teste Loes. 1902. The type specimen has only dehiscent capsules, which do not show the shape of the capsule very well. This species may possibly be in the *Myrianthi* Series, near *E. uniflorus* Lévl. The latter species has narrower leaves.
104. **E. oblongifolius** Loes. et Rehd. in Sargent Pl. Wilson **1**, 486 (1913). China (Hupeh). Capsule unknown ; possibly in Series *Myrianthi*.
105. **E. vagans** Wall. ex Roxb. Fl. Ind. ed. Carey **2**, 412 (1824). (*E. bockii* Loes. ; *E. hupehensis* Loes. var. *brevipedunculatus* et var. *maculatus* Loes. in Engl. Bot. Jahrb. **30**, 454 (1902)). E. Himalaya (Nepal, Sikkim), Assam, S.E. Tibet (Tsarong), China

(Szechwan, Yunnan). The size of the leaves and of the capsules vary greatly in this species. The subsp. and the typical form merge into each other.

subsp. **macrophyllus** Kanj., Kanj., Das et Purk. Fl. Assam. **1**, II, 264 (1933). Assam, China (Yunnan).

106. **E. fortunei** (Turcz.) Hd.-Mazz. Symb. Sin. VII, 660 (1933). (*E. radicans* Sieb. var. *acutus* Rehd.). Corea, China (Chekiang, Kiangsu, Hupeh, Honan, Anwhei). In some forms the ovoid buds are as much as 7–10 mm. long.

Varieties and forms of *F. fortunei* (see Rehder 1940) and key.

var. **angustifolius** (Graebner) Nakai in Journ. Jap. Bot. **17**, 679 (1941) Japan.

var. **alticola** Hand.-Mazz. Symb. Sin. VII, 660 (1933) e descr. China (Yunnan). There is some doubt on the position of this variety. Its habit is described as “frutex, saepe e rupibus pendens vel (e Ten) arbor ad 6 m. alta”. Ten is one of the collectors.

f. **carrierei** (Vauvel) Rhd. Man. Cult. Trees and Shrubs ed. 2, 559 (1940) including “Silver Queen”. Cult. Bean suggests that this is a form of *radicans* rooted like “tree” ivy.

f. **coloratus** (Rehd.) Rehd. l.c. Cult.

f. **gracilis** (Reg.) Rehd. l.c. (var. *argenteo-marginatus* Rehd., *pictus* J. Makoy, *roseo-marginatus* Rehd., *tricolor* Reg.). Cult.

f. **minimus** (Simon-Louis) Rehd. l.c. (var. *kewensis* Bean, *E. kewensis* Hort. ex Hesse, f. *kewensis* (Bean) Rehd. in Journ. Arn. Arb. **28**, 445 (1947)). Cult. Fls. and capsule unknown. Bean suggests that this may be a distinct species or a juvenile form. Rehder (1947) separates f. *minima* (leaves 8–15 mm. long) from f. *kewensis* (leaves 5–8 mm. long), but spms. at Kew are intermediate between these two extremes.

f. **pictus** Dippel Handb. Laubh. **2**, 495 (1891). Cult.

f. **pulchellus** Dippel l.c. 495.

var. **radicans** (Sieb. ex Miq.) Rehd. l.c. Japan, Corea, China (Hupeh, Szechwan).

f. **reticulatus** (Reg.) Rehd. l.c. (var. *pictus* Rehd.).

var. **vegetus** (Rehd.) Rehd. l.c. Japan.

var. **viridis** (Regel) in Gartenfl. **15**, 261 (1866).

var. **villifolius** Nakai in Journ. Jap. Bot. **17**, 680 (1941). Japan.

var. **villosus** Nakai in l.c. **17**, 680 (1941). Japan.

107. **E. japonicus** Thunb. in Nov. Act. Soc. Sc. Upsal. **3**, 208 (1780) (*Pragmotessera japonica* Pierre, *E. sinensis* Carrière). Corea, Japan, Liukiu Isl. The ovoid buds may be 7–12 mm. long.

var. **albo-marginatus** T. Moore ex Rehd. l.c. Cult.

var. **argenteo-variegatus** Regel Ind. Sem. Hort. Bot. Imp. Petrop. 102 (1866). Cult.

var. **aureus** Carrière in Rev. Hort. 248 (1864); *Bean Trees and Shrubs* Hardy in Brit. Is. ed. 1, **1**, 539 (1914). Cult.

var. **aureo-marginatus** Regel l.c. 102. Cult.

var. **aureo-variegatus** Regel l.c. 102. Cult.

- var. **calamistratus** *Mouillef.* *Traité d. Arbres et Arbriss.* **2**, 752 (1892–8). Cult.
- var. **chinensis** *Pamp.* in *Nuov. Giorn. Bot. Ital.* **17**, 419 (1910) e descr. China (Hupeh). Probably not in this species.
- var. **crispus** *Regel* l.c. 102. Cult.
- var. **elegans** *André* in *Rev. Hort.* 236 (1883). Cult.
- var. **fastigiatus** *Carr.* ex *Rehd.* l.c. Cult.
- f. **flavescens** *Dippel* *Handb. Laubh.* **2**, 495 (1891). Cult.
- var. **latifolius** *Regel* l.c. 102. Cult.
- var. **longifolius** *Nakai* in *Bot. Mag. (Tokyo)* **42**, 451 (1928) e descr. Japan.
- var. **macrophyllus** *Regel* l.c. 103 (*robustus* Hort.) Cult.
- var. **mediopictus** *Davis* in *Ann. Missouri Bot. Gard.* **16**, 199 (1929) nomen nudum. Cult.
- var. **microphyllus** *Jacq.* ex *Rehd.* l.c. (*E. microphyllus* Carrière, *E. dentatus* Carrière). Cult.
- var. **ovatus** *Carrière* in *Rev. Hort.* 248 (1864) ; *Regel* l.c. 102. Cult.
- var. **prunifolius** *Siebold* ex *Mord* in *Rev. Hort.* 285 (1883). Cult.
- var. **pyramidatus** *Carr.* ex *Rehd.* l.c. (var. *columnaris* Carr. ; var. *pyramidalis* Hort.) Cult.
- f. **punctatus** *Dippel* l.c. 495. Cult.
- var. **radicifer** *Nakai* in *Bot. Mag. (Tokyo)* **41**, 509 (1928) e descr. Japan. Described as like *E. japonicus* var. *macrophyllus*, but sending out radicant stolons at the base. In this species?
- var. **rugosus** *Nakai* in *Bot. Mag. (Tokyo)* **46**, 165 (1932) e descr. Japan.
- f. **sulphureus** *André* in *Rev. Hort.* 236 (1883), *Dippel* l.c. 495. Cult.
- var. **sulphureo-variegatus** *Regel.* l.c. 103. Cult.
- var. **typicus** *Regel.* l.c. 102. Cult.
- var. **variegatus** *Bateson* in *Journ. Genetics* **8**, 95 (1919) nomen nudum. Cult.
- var. **viridi-variegatus** *Rehd.* l.c. (Duc d'Anjon). Cult.

Most of the cultivated varieties given above are taken from *Regel* l.c. and from *Rehder's Manual*. A few varieties are insufficiently well known to be entered in the key.

The variegated plants of this species and of *E. fortunei* are perhaps not best described as "varieties" and "forms". Some of them have been investigated anatomically and physiologically. *Bateson* (*Journ. Genetics* **8**, 93–99 (1919)) states that "*E. japonicus latifolius* var. *variegatus*" is a periclinal chimaera. *Massey* (l.c. **19**, 357–373 (1928)) reached the same conclusion on "*E. pictus aureus*" and "*E. pictus argenteus*".

Other workers have reported an "infectious chlorosis", somewhat of the same nature as a virus, in association with other types of variegation, which are not infectious. *Davis* discusses this in *Ann. Miss. Bot. Gard.*

- 13, 425 (1929) (bibliography). Baur also has a paper on the point (Ber. Deutsch. Bot. Gesellsch. **26A**, 711–713 (1908)).
108. **E. boninensis** Koidz. in Bot. Mag. Tokyo **32**, 250 (1918). Bonin Is. Probably only a variety of *E. japonicus* from which it differs mainly in being smaller in all parts.
109. **E. kiautschovicus** Loes. in Engl. Jahrb. **30**, 453 (1902) (*E. patens* Rehd., *E. chinensis* Lindl. var. *hupehensis* Loes. ex Diels in Engl. Bot. Jahrb. **29**, 436 (1900); *E. hupehensis* Loes. var. *longepedunculatus* Loes. in l.c. **30**, 454 (1902)). China (Kwantung, Kiangsu, Shantung, Hupeh, Honan, Anwhei), Hainan.
110. **E. orgyalis** W. W. Sm. in Notes R. Bot. Gard. Edinb. **13**, 161 (1921). (*E. subsessilis* Sprague var. *latifolius* Loes. p.p.?) China (Yunnan, Szechwan).
111. **E. griffithii** Kurz. in Journ. As. Soc. Beng. **41**, II, 73 (1872). (*Hippocratea angulata* Griff. teste Lawson). Upper Burma.
112. **E. sootepensis** Craib in Kew Bull. 148 (1912). Siam.
113. **E. venosus** Hemsl. in Kew Bull. 210 (1893). China (Hupeh, Shensi, Szechwan).
114. **E. hederaceus** Champ. ex Benth. in Hook. Kew Journ. **3**, 333 (1851). China (Kwantung). The buds resemble in external appearance those of the Subgenus *Kalonymus*. The young leaves are obvolute in the bud.
115. **E. tonkinensis** Loes. in Engl. Jahrb. **30**, 453 (1902) (*E. chinensis* Lindl. var. *tonkinensis* Loes.). Tonkin. The only specimen seen is "Bip, prés de Tu-Phap, Jan. 1889, Balansa 3979" (in fruit). This has somewhat wider leaves than in the published descriptions. The flowers are figured by Pitard in Pierre's Fl. Gen. Ind.-Chin. **1**, 872, fig. 108 (1911).

The following species are probably in this series :

116. **E. corymbosus** Sprague et Bullock in Hook. Ic. Pl. **34**, t. 3396 (1939). Mexico. See note under *E. costaricensis* (no. 145).
117. **E. petelotii** Merr. in Journ. Arn. Arb. **19**, 41 (1938) e descr. Tonkin.
118. **E. yoshinagae** Makino in Journ. Jap. Bot. **3**, 3 (1913) e descr. Japan.
119. **E. chloranthoides** Yang in Journ. West China Border Res. Soc. **15**, ser. B, 90 (1945) e descr. China (Szechwan). "Capsule . . . 3–5 (usually 4-) valved". Capsules more deeply lobed than in the rest of this Series.

KEY TO SERIES 11. TUBERCVLATI (LOES.) STAT. NOV.

A. Leaves ovate to linear-lanceolate, acuminate or acute

B. Erect shrub, 0.5–2.5 m. high

C. Leaves ovate to oblong-lanceolate, deciduous

120. *americanus* L.

CC. "Foliis elongato-lineari-ellipticis," semipersistent

120. *americanus* L. var. *angustifolius* (Pursh) Wood.

- BB. Stem sarmentose, often radicans, leaves ovate lanceolate, acute
 120. *americanus* L. var. *sarmentosus* Nutt.
- AA. Leaves obovate, obtuse ; decumbent shrub up to 0.3 m. high,
 rooting on the prostrate stems
 121. *obovatus* Nutt.

SERIES 11. TUBERCULATI (LOES.) STAT. NOV.

120. **E. americanus** L. Sp. Pl. 197 (1753) (*E. muricatus* Rafin., *E. scandens* Hort., *E. sempervirens* Marsh). N. America (southern New York to Florida, Illinois, Nebraska and Texas).
 var. **angustifolius** (Pursh) Wood The Am. Bot. and Florist 76 (1871). N. America (Georgia).
 var. **sarmentosus** Nutt. Gen. Am. 1, 154 (1818) e descr. N. America (no precise locality).
121. **E. obovatus** Nutt. in Gen. Am. 1, 155 (1818). N. America (southern Ontario to Pennsylvania, northern New Jersey (?), Illinois, Michigan, Kentucky teste Britton & Brown Ill. Flor. N.U.S. and Canada).

KEY TO SERIES 12. ECHINATI (LOES.) STAT. NOV.

- A. Cymes contracted into a dense umbel-like infl.
 124. *contractus* Sprague
- AA. Cymes not contracted
- B. Capsules greyish-green or grey in sicco
- C. Petioles 2–7 mm. long ; leaves lanceolate acuminate
- D. Lateral veins and midrib prominent above and below ; peduncle 3–5.8 cm. long
 122. *acuminatus* Benth.
- DD. Lateral veins not prominent above or below, midrib very prominent above ; peduncle up to 0.8 cm. long
 123. *mexicanus* Benth.
- CC. Petioles 5–20 mm. long ; leaves various
- E. Petioles 5–12 mm. long ; leaves obovate to rhomboid elliptic, rounded to acuminate
- F. Prickles on capsule 2–2.5 mm. long
 125. *cinereus* Lawson
- FF. Prickles on capsule 6 mm. long
 126. *angustatus* Sprague
- EE. Petioles 10–20 mm. long ; leaves lanceolate acuminate
 134. *wilsonii* Sprague
- BB. Capsules tawny, brown or blackish in sicco
- G. Leaves elliptic or obovate
- H. Prickles on capsule 2 mm. long
- I. Petioles 8–15 mm. long ; leaves up 12 cm. long ; twigs conspicuously tuberculate (for vars. see below)
 127. *acanthocarpus* Franch.

- II. Petioles 2–7 mm. long ; leaves up to 7 cm. long ; twigs not or less tuberculate
 - J. Leaves reticulate below 128. *benguetsensis* Merrill.
 - JJ. Leaves not reticulate below 129. *trichocarpus* Hayata.
 - HH. Prickles 3–4 cm. long 130. *hemsleyanus* Loes.
 - GG. Leaves oblong, ovate or lanceolate
 - K. Prickles 4–7 mm. long
 - L. Petioles 4–8 cm. long
 - M. Leaves 6–8 cm. long, 2–4 cm. wide, more coarsely serrate 131. *actinocarpus* Loes.
 - MM. Leaves 8–14 cm. long, 2.5–5.5 cm. wide, more finely serrate 132. *hystrix* W. W. Sm.
 - LL. Petioles 10–20 cm. long
 - N. Leaves thick, coriaceous, flavescent in sicco 133. *aculeatus* Hemsl.
 - NN. Leaves thinner, greyish-green in sicco, veins more prominent below 134. *wilsonii* Sprague
 - KK. Prickles 1–4 cm. long
 - O. Petioles 8–15 mm. long
 - (1) Leaves lanceolate or oblanceolate, up to 4 cm. wide, shrub or tree 3–40 ft. high 127. *acanthocarpus* Fr.
 - (2) Climbing shrub, otherwise as in type 127. *acanthocarpus* var. *scandens* (Loes.) comb. nov.
 - (3) Differs from type in veins on leaf more conspicuous below, laxer infl. 127. *acanthocarpus* var. *sutchuenensis* Franch.
 - (4) Leaves oblong-lanceolate or ovate, up to 5–6.5 cm. wide 127. *acanthocarpus* var. *longipes* (Lace) stat. nov.
 - OO. Leaves sessile or with petioles 1–7 mm. long
 - P. Leaves sessile 138. *mupinensis* Loes. et Rehd.
 - PP. Petioles 1–7 mm. long
 - Q. Veins very oblique, slightly curved, relatively inconspicuous ; prickles 2.5–3.5 mm. long, not flattened 136. *scandens* R. Grah.
 - QQ. Veins spreading or oblique, strongly curved, forming a distinct network of arches

- R. Prickles 1-1.5 mm. long not flattened
- S. Veins prominent or conspicuous below ;
prickles dense with their bases almost touching
each other
- T. Leaves with 6-9 patent or patulous veins on
each side of midrib ; peduncles more slender
137. *echinatus* Wall.
- TT. Leaves with 4-7 rather oblique veins on
each side of midrib ; peduncles stouter
139. *subsessilis* Sprague
- SS. Veins not prominent nor conspicuous below ;
prickles dense or sparse.
- U. Leaves evergreen
- W. Prickles sparse ; leaves lanceolate or
elliptic rarely subovate
- X. Peduncles and pedicels stout, peduncles
c. 1 mm. wide
140. *spraguei* Hayata
- XX. Peduncles and pedicels slender, pedun-
cles c. 0.5-0.75 mm. wide
142. *chuii* Hd.-Mzz.
- WW. Prickles dense, bases almost touching ;
leaves ovate to wide elliptic 1.4-4.7 cm.
long, 0.9-2.3 cm. wide
141. *sp. nov.*? (Cheo 417)
- UU. Leaves deciduous
143. *chenmoui* Cheng
- RR. Prickles 3-4 mm. long, \pm flattened
135. *balansae* Sprague

SERIES 12. ECHINATI (LOES.) STAT. NOV.

- 122. **E. acuminatus** Benth. Pl. Hartz. 59 (1839). Mexico.
- 123. **E. mexicanus** Benth. Pl. Hartw. 36 (1839). Mexico. The
capsules are shown on "between Guerrero and Omitlán, nr.
Huasca, Hgo., Aug. 1946, *M. Martinez*."
- 124. **E. contractus** Sprague in Kew Bull. 31, 34 (1908). China
(Yunnan, Szechwan).
- 125. **E. cinereus** Lawson in Hook. f. Fl. Brit. Ind. **1**, 611 (1875).
Assam.
- 126. **E. angustatus** Sprague in Kew Bull. 33, 35 (1908). China
(Kwantung).
- 127. **E. acanthocarpus** Franch. Pl. Delav. 129 (1889). China (Hupeh,
Anhwei, Szechwan, Yunnan), S.E. Tibet (Tsarong).
var. **longipes** (Lace) stat. nov. (*E. laxus* Wang in Contrib. Bot.
Surv. N.W. China **1**, 12 (1939)). Burma, China (Hupeh,
Cheichow). Lace's description calls this "frutex grandis vel

- arbuscula". One specimen (Gamble 38) shows adventitious roots on a young branch.
- var. **sutchuenensis** *Franch.* ex Diels in *Engl. Bot. Jahrb.* **29**, 439 (1900). Szechwan.
- var. **scandens** (*Loes.*) comb. nov. (*E. theifolius* Wall. var. *scandens* Loes. in *Engl. Bot. Jahrb.* **30**, 3455 (1902)). Yunnan.
128. **E. benguetensis** *Merrill* in Philip. Gov. Lab. Bur. Bull. **29**, 26 (1905). Philippine Is.
129. **E. trichocarpus** *Hayata* in Journ. Coll. Sci. Tokyo **25**, Art. 19, 69 (1908) (*E. arboricolus* Hayata; ? *E. kuraruensis* Hayata). Formosa.
130. **E. hemsleyanus** *Loes.* in *Engl. Jahrb.* **30**, 460 (1902). China (Yunnan).
131. **E. actinocarpus** *Loes.* in *Engl. Jahrb.* **30**, 459 (1902). China (Hupeh).
132. **E. hystrix** *W. W. Sm.* in Notes R. Bot. Gard. Edinb. **13**, 160 (1901). China (Yunnan).
133. **E. aculeatus** *Hemsl.* in Kew Bull. 209 (1893). China (Hupeh, Szechwan, Yunnan).
134. **E. wilsonii** *Sprague* in Kew Bull. 180 (1908). China (Szechwan). The type specimen (Wilson 3330) has tawny capsules in the dried state. The only other specimen in Herb. Kew. (Szechwan: Omei Hsien, Mt. Omei, 18.8.1928, *Fang* 3139) shows greenish capsules.
135. **E. balansae** *Sprague* in Kew Bull. 180 (1908). (*E. rhodacanthus* Pitard). Tonkin.
136. **E. scandens** *R. Graham* in Edinb. N. Phil. Journ. 386 (1827). Himalaya (Nepal).
137. **E. echinatus** *Wall.* ex Roxb. Fl. Ind. ed. Carey **2**, 410 (1824) (*Pragmotessera echinata* Pierre). E. & W. Himalaya.
138. **E. mupinensis** *Loes. et Rehd.* ex Sargent Pl. Wils. **1**, 489 (1913). China (Yunnan, Szechwan).
139. **E. subsessilis** *Sprague* in Kew Bull. 32, 34 (1908). China (Hupeh, Szechwan).
var. *latifolius* *Loes.* ex Sargent Pl. Wils. **1**, 489 (1913). China (Szechwan). The type number (Wilson 1216) in Herb. Kew. has unarmed capsules and appears to be *E. orgyalis* W. W. Sm.
140. **E. spraguei** *Hayata* in Journ. Coll. Sci. Tokyo **30**, Art. 1, 59 (1911). Formosa.
141. *Sp. nov.*? Kiangsi: Lu Shan, Kuan Yin Ch'iao, shrub, 1 m. in height, in ditch, 4.10.1932, *H. C. Cheo* 417. Possibly the same as *E. fungosus* Ohwi.
142. **E. chuii** *Hand.-Mazz.* in Oest. Bot. Zeit. **90**, 121 (1941). China (Yunnan, Szechwan).

143. **E. chenmoui** Cheng in Contrib. Biol. Lab. Sci. Soc. China, Bot. Ser. **10**, 75 (1935) e descr. China (Anhwei).

In this series, but position uncertain :

144. **E. acanthoxanthus** Pitard ex Lecomte Fl. Gen. Indo-Chine **1**, 870 (1912) e descr. Tonkin.
145. **E. costaricensis** Standley in Publ. Field Mus. Nat. Hist. Chicago. Bot. Ser. **18**, 631 (1937). Costa Rica. A specimen so-named at Kew (*Skutch* 3588) differs from Standley's description in petioles up to 1 cm. long (not 4–6 mm. long) and the fruit which are of the type found in Sect. *Ilicifolia* (not obtusely tuberculate). It shows a very strong resemblance to the Mexican *E. corymbosus* Sprague et Bullock, of which ripe fruit are unknown.
146. **E. fungosus** Ohwi in Act. Phytotax. et Geobot. **5**, 186 (1936) e descr. Liukiu Is.
147. **E. subtrinervis** Rehd. in Journ. Arn. Arb. **14**, 247 (1933) e descr. (*Echinocarpus esquirolii* Lévl. in Fedde Rep. Sp. Nov. **10**, 474 (1912) non *Euonymus esquirolii* Lévl. ; *Echinocarpus cavaleri* Lévl. ; *Euonymus blinii* Lévl. Fl. Kouy. Tcheou **71** (1914) non in Fedde Rep. Spec. Nov. **13**, 259 (1914) ; *Euonymus cavaleri* Lévl. Fl. Kouy-Tcheou **71** (1914) non in Fedde Rep. Sp. Nov. **13**, 259 (1914)). China (Kweichow). Perhaps not distinct from *subsessilis* Sprague. Leaves described as "3-nerved at the base."

Probably in this series :

- E. poilanei** Tardieu ex Humbert Suppl. Fl. Gén. Ind.-Chine **1**, 788 (1948).

SUBGENUS KALONYMUS BECK.

KEY TO SERIES 13. MACROGEMMI (NAKAI) STAT. NOV.

- A. Flowers 5-merous (rarely 3-merous)
- B. Leaves ovate, obovate or oblong
- C. Capsule winged, wings 1–7 mm. long, rounded, usually directed laterally or backwards
- D. Leaves oblong or elliptic-oblong, rarely obovate-oblong, abruptly and narrowly acuminate ; capsule wings 10–12 mm. long, 2.5 mm. wide
168. *szechuanensis* Wang
- DD. Leaf serration finer, leaves oblong-elliptic, rarely obovate-elliptic, acute or shortly acuminate ; capsule wings 2–7 mm. long, rounded
- E. Leaves deciduous
148. *latifolius* Scop.
- (i) Leaves 9–10 cm. long
148. *latifolius* var. *grandifolius* Rouy et Fouc.
- (ii) Leaves 6–7 cm. long
148. *latifolius* var. *parvifolius* Rouy et Fouc.

- (iii) Leaves up to 17.5 cm. long
148. *latifolius* var. *eximia* Beck.
- (iv) Leaves 4.5–8 cm. long, flowers slightly smaller, petals 2–2.5 mm. long, 2 mm. wide (not 2.5–3.5 mm. long, 2–3 mm. wide), low-growing
148. *latifolius* f. *umbrosus* E. Busch.
- EE. Leaves semipersistent
148. *latifolius* f. *sempervirens* (Rupr.) E. Busch.
- DDD. Leaf serration coarser, leaves ovate, markedly acuminate, capsule wings 1–4 mm. long
- F. Capsule scarcely winged (wing 1 mm. long)
149. *planipes* Koehne
- FF. Capsule markedly winged (wing up to 4 mm. long)
- G. Infl. c. 7-fl., 5-locular capsules
150. *sachalinensis* (Schmidt) Max.
- GG. Infl. c. 3-fl., 3-locular capsules
151. *tricarpos* Koidz.
- CC. Capsule unwinged
 - (i) Leaves c. 7 cm. long, 3–4 cm. (rarely 5) wide ; capsule 5–8 mm. long, 1–1.2 cm. wide
152. *oxyphyllus* Miq.
 - (ii) Leaves c. 8.5 cm. long, 4–5.5 cm. wide ; capsule 1 cm. long, 1.4 cm. wide
152. *oxyphyllus* var. *yessoensis* (Koidz.) stat. nov.
 - (iii) Leaves up to 5.5 cm. long, 1.8 cm. wide ; capsule 1 cm. long, 1 cm. wide
152. *oxyphyllus* var. *nipponicus* (Max.) stat. nov.
- BB. Leaves lanceolate ; peduncle up to 7 cm. long ; calyx 4–5 mm. in diam., fl. 7–16 mm. in diam. across petals, petals rounded ; capsule wings 5–10 mm. long, tapering, directed forwards
 - H. Petals green
156. *clivicolus* W. W. Sm.
 - HH. Petals purple
156. *clivicolus* var. *rongchuensis* (Marq. et Shaw) stat. nov.
- AA. Flowers 4-merous
 - I. Capsule winged, trunk and branches grey or brown
 - J. Leaves thin, veins prominent beneath, less finely reticulate on both surfaces
 - K. Leaves ovate, obovate or oblong
 - L. Capsule wings 1–7 mm. long (10–15 mm. in *E. latifolius* f. *sempervirens*), rounded usually directed backwards or laterally ; petals rounded ; (generally 5-merous)
 - M. Leaf serration finer, leaves oblong-elliptic rarely elliptic, acute or shortly acuminate capsule wings 2–7 mm. long (see above for vars.)
148. *latifolius* (L.) Mill.

- MM. Leaf serration coarser, leaves ovate markedly acuminate, capsule wings c. 4 mm. long
149. *planipes* Koehne
- LL. Capsule wings 5–11 mm. long, \pm tapering
- N. Petals white or greenish, ovate or orbicular
- O. Leaf serration more coarsely serrate or fimbriate, serrations more incurved, apex shortly acuminate ; leaves 1.4–11 cm. long, generally 6–8 cm. long, 0.9–6 cm. wide ; petiole 2–11 mm. long, generally 6–7 mm. long ; calyx 2–3 mm. diam., fls. 5–7 mm. diam. across petals ; petals ovate, sub-acute ; capsule wings 6–15 mm. long, tapering, directed laterally, rarely somewhat backwards
- P. Leaf margin irregularly biserrate or fimbriate
153. *fimbriatus* Wall.
- PP. Leaf margin serrate
153. *fimbriatus* Wall. var. *serratus* var. nov.
- OO. Leaf serration less coarse, apex long acuminate
- Q. Leaves larger 1.6–10.8 cm. long, 0.9–5.8 cm. wide, generally 7–9 cm. long ; petiole 2–8 mm. long, generally c. 5 mm. long ; peduncle 2.4–6.5 cm. long, generally over 3.5 cm. long ; calyx 3–5 mm. diam., fls. c. 7 mm. diam. across petals, petals orbicular, rounded ; capsule wings 6–11 mm. long, directed forwards
154. *macropterus* Rupr.
- QQ. Leaves smaller 1.5–7.5 cm. long, 0.7–3.6 cm. wide, generally 4–5 cm. long ; petiole 2–10 mm. long, generally 6–7 mm. long ; peduncle 1.4–6 cm. long, generally under 3.5 cm. long ; calyx 2–3 mm. in diam., fls. 4–7 mm. diam. across petals, petals orbicular rounded or ovate subacute ; capsule wings 5–10 mm. long, tapering, directed forwards or laterally
155. *usuriensis* Max.
- NN. Petals purple, oblong-ovate, subacute
158. *porphyreus* Loes. var. *ellipticus* var. nov.
- KK. Leaves lanceolate.
- R. Shrubs or trees, 4–25 ft. high, leaves acute or acuminate, deciduous
- S. Peduncle usually 3–4 cm. long, rarely up to 5.5 cm. long ; petals purple, fls. 5–8 mm. diam. across petals
- T. Leaves less acuminate ; calyx c. 3 mm. diam., petals rounded ; capsule wings 2–7 cm. long, 6–10 mm. wide at base, less tapering, directed forwards or laterally
157. *amygdalifolius* Franch.

- TT. Leaves more acuminate ; calyx 2-3 mm. diam., petals subacute ; capsule wings 5-9 cm. long, 3-5 cm. wide at base, tapering directed forwards rarely backwards
158. *porphyreus* Loes.
- SS. Peduncle usually 6-15 cm. long, rarely 3 cm. long ; calyx 3-4 mm. diam., petals green, rounded ; fls. 6-8 mm. diam. across petals ; capsule wings 4-18 mm. long, 6-9 mm. wide at base, rounded or somewhat tapering, directed backwards or laterally
159. *elegantissimus* Loes. et Rehd.
- RR. Subshrub, 1-2 ft. high, leaves \pm rounded or acute, leaves generally semipersistent
169. *pygmaeus* W. W. Sm.
- JJ. Leaves thick, veins subprominent below, finely reticulate on both surfaces
- U. Infl. 3-16-fl., petals ovate ; capsule wings 4-7 mm. long, 5-10 mm. wide at base, rounded, directed laterally rarely forwards
160. *sanguineus* Loes.
- (i) Leaves wide oval or wide ovate, lateral veins straight, rarely slightly curved towards apex ; peduncle 4.5-6 cm. long
160. *sanguineus* var. *orthoneurus* Loes.
- (ii) Paler in sicco, leaves oval or ovate to ovate elliptic, lateral veins \pm curved towards apex, basal 2-3 markedly longer than the upper ones ; peduncle 4.5-6 cm. long
160. *sanguineus* var. *camptoneurus* Loes.
- (iii) Infl. laxer, peduncle c. 5-7 cm. long
160. *sanguineus* var. *laxus* Loes.
- (iv) Peduncle up to 2.6 cm. long
160. *sanguineus* var. *brevipedunculatus* Loes.
- UU. Infl. 13 or more flowered, rarely 9-fl. ; petals lanceolate ; capsule wings 3-6 mm. long, 5-10 mm. wide at base, rounded, directed laterally or forwards
161. *monbeigii* W. W. Sm.
- II. Capsule scarcely 4-sulcate, trunk and branches green
162. *yakushimensis* Makino

SERIES 13. MACROGEMMI (NAKAI) STAT. NOV.

148. **E. latifolius** (L.) Mill. in Gard. Dict. ed. 8, n. 2 (1768). (*E. europaeus* L. β . *latifolius* L. Sp. Pl. 197 (1753) ; *Pragmotessera latifolia* Pierre). Europe (Pyrenees, Alps, Central and S.E. Europe), Caucasus, Asia Minor, N. Persia, Algeria.
var. **eximius** Beck in Fedde Rep. Sp. Nov. **17**, 451 (1921) e descr. Bosnia.

- var. **grandifolius** Rouy et Rouc. Fl. de France **4**, 160 (1897). France.
- var. **parvifolius** Rouy et Rouc. Fl. de France **4**, 160 (1897). France.
- f. **sempervirens** (Rupr.) E. Busch Fl. Cauc. Crit. **3**, VIII, 44 (1912). (*E. leiophloeus* Stev., *Kalonymus leiophloeus* (Stev.) Prokh. in Fl. U.S.S.R. **14**, 572 (1949)). Prokhanov describes this as 4-merous and capsule wings 10–15 mm. long). Caucasus.
- f. **typicus** E. Busch l.c. 42. Caucasus.
- f. **umbrosus** E. Busch l.c. 45 e descr. Caucasus.
149. **E. planipes** Koehne (in Mitteil. Deutsch. Dendrol. Ges. 62 (1906)). Japan. Possibly not distinct from *E. sachalinensis*.
150. **E. sachalinensis** (Schmidt.) Max. in Bull. Acad. Petersb. **28**, 446 (1881) (*E. latifolius* Scop. var. *sachalinensis* Schmidt.; *E. kansuensis* Nakai; *Kalonymus maximowicziana* Prokh.; *E. erosidens* Prokh.). Manchuria, Korea, Sachalin, Japan, China (Kansu).
151. **E. tricarpos** Koidz. in Ic. Pl. Koisikav **3**, 77, t. 184 (1916) e descr. Japan. Perhaps only a form of *E. sachalinensis*.
152. **E. oxyphyllus** Miq. in Ann. Mus. Bot. Lugd. Bot. **2**, 86 (1865–6) (*E. latifolius* A. Gray non Scop.; *E. laxiflorus* Blume non Champ.). Korea, Japan, China (Anwei, Chekiang). Intermediates occur between the first two varieties and the typical form.
- var. **yesoensis** (Koidz.) stat. nov. Japan.
- var. **nipponicus** (Max.) stat. nov. Japan.
- var. **kuenbuergia** Honda in Bot. Mag. (Tokyo) **47**, 297 (1933) e descr. Japan; Nakai in l.c. **49**, 417 (1935) reduces this to a synonym of *E. sachalinensis*.
153. **E. fimbriatus** Wall. ex Roxb. Fl. Ind. ed. Carey **2**, 408 (1824). (? *E. micranthus* D. Don). Afghan, India (Himalaya).
- var. **serratus** var. nov. Folia margine uniserrata (haud irregulariter biserrata vel fimbriata).
- W. HIMALAYA. Chamba State, Chari, Pangi, 7,500 ft., often a small tree, 20.6.1920, R. N. Parker (type of var.); Kashmir, Tragbol, 8,000 ft., 19.7.1876, C. B. Clarke 29200A.
154. **E. macropterus** Rupr. in Bull. Phys.-Math. Acad. Petersb. **15**, 359 (1857). Manchuria, Korea, Sachalin, Japan.
155. **E. usuriensis** Max. in Bull. Acad. Petersb. **27**, 449 (1881) (*E. giraldii* Loes. var. *genuina* Loes. et var. *ciliata* Loes. ex Diels in Engl. Bot. Jahrb. **29**, 443 (1900) et var. *angustialata* Loes. ex Sargent Pl. Wils. **1**, 495 (1913)). Manchuria, Korea, China (Hupeh, Honan, Kansu, Shensi, Szechwan). Possibly only a variety of *E. macropterus*.
156. **E. clivicolus** W. W. Sm. Notes R. Bot. Gard. Edinb. **10**, 31 (1917). China (Yunnan).
- var. **rongchuensis** (Marq. et Shaw) stat. nov. S.E. Tibet, N. Assam,

China (Szechwan, Yunnan). Commoner than the typical form.

157. **E. amygdalifolius** Franch. in Bull. Soc. Bot. Fr. **33**, 453 (1886) (*E. taliensis* Loes.). Himalaya (Kumaun, Sikkim), N. Burma, S.E. Tibet, China (Yunnan). This species was originally described by Franchet as 4-merous. His type specimen at Paris (*non vidi*) has been examined by Comber, who considers it conspecific with Forrest 15752, 17511 etc., which are represented at Kew (see Notes R. Bot. Gard. Edinb. **18**, 239 (1934)). A specimen at Kew (Yunnan : in monte Tsang-chan, supra Tali, 1883-5, *Delavay* 1891) shows 5-merous flowers and larger calyces and must be placed in *E. clivicolus*. *Delavay's* specimen at Paris from the same locality and bearing the same number is regarded as the type of *E. amygdalifolius*.
158. **E. porphyreus** Loes. in Notes R. Bot. Gard. Edinb. **8**, 2 (1913). China (Kansu, Shensi, Szechwan, Yunnan). A number of specimens have been seen which show the characteristic flowers, and long acuminate leaf apices of *E. porphyreus*, but which have wide elliptic leaves.
 var. **ellipticus** var. nov. Folia late elliptica, 2.1-8.7 cm. longa, 1.1-5 cm. lata.
 CHINA (SZECHWAN). Tachlien-lu, 9,000-13,500 ft., *Pratt* 353 ; Feb. 1890, *Henry* 8795 ; Washan, 1,600-2,600 m., woodlands, *Wilson* 968 bis ; on the mountains east of Yungning, 27° 48' N. 101° E., 10,000 ft., in thickets by streams in side valleys, shrub 20-25 ft., fls. purple maroon, June 1922, *Forrest* 21240 (type of var.) ; Tien-chuan-hsien, 2,800 m., 24.5. and 12.6.1936, *K. L. Chu* 2630, 2754.
 W. HUPEH. Hsingshan Hsien, woodlands, 1,300-2,300 m., 5.6.1907, *Wilson* 356 bis.
159. **E. elegantissimus** Loes. et Rehd. in Sargent Pl. Wils. **1**, 496 (1913). China (Hupeh, Kweichow).
160. **E. sanguineus** Loes. ex Diels in Engl. Jahrb. **29**, 441 (1900). S.E. Tibet, China (Hupeh, Kansu, Szechwan, Yunnan).
 var. **brevipedunculatus** Loes. ex Sargent Pl. Wils. **1**, 495 (1913). China (Szechwan).
 var. **camptoneurus** Loes. ex Diels in Engl. Bot. Jahrb. **29**, 442 (1900). China (Shensi, Szechwan).
 var. **laxus** Loes. l.c. **30**, 465 (1902). China (Shensi).
 var. **orthoneurus** Loes. l.c. **29**, 442 (1900). China (Hupeh, Szechwan).

These varieties do not seem to be very distinct.

var. **pachyphyllus** Pampanini e descr. in Nuov. Giorn. Bot. Ital. **17**, 420 (1910). China (Hupeh). In this species?

161. **E. monbeigii** W. W. Sm. in Notes R. Bot. Gard. Edinb. **10**, 34 (1917). S.E. Tibet, China (Szechwan, Yunnan).

The following species and variety are probably in this series :

162. **E. yakushimensis** Makino in Bot. Mag. Tokyo **23**, 248 (1909) e descr. Japan. Affinities somewhat uncertain.
163. **E. crinitus** Pampanini Nuov. Giorn. Bot. Ital. **17**, 417 (1910) e descr. China (Hupeh).
var. **minor** Pampanini e descr. in Nuov. Giorn. Bot. Ital. **17**, 417 (1910). China (Hupeh).
164. **E. dasydictyon** Loes. et Rehd. ex Sargent Pl. Wilson **1**, 496 (1913) e descr. China (Szechwan).
165. **E. robustus** Nakai in Bot. Mag. Tokyo **28**, 307 (1914) e descr. Corea. Rehder (1949) sinks this in *E. sachalinensis*.
166. **E. schensianus** Max. in Bull. Acad. Petersb. **27**, 444 (1881) e descr. (*E. haoi* Loes. ex Wang e descr.). China (Shensi).
167. **E. schottii** Ettingsh. ex Vis. in Act. Ist. Ven. Sc. Ser. III, **4**, 140 (1838-9) e descr. Cult.
168. **E. szechuanensis** Wang in Contrib. Bot. Surv. N.W. China **1**, 49 (1939) e descr. China (Szechwan). Not stated if evergreen or deciduous.

KEY TO SERIES 14. CORNUTI (LOES.) STAT. NOV.

A. Flowers 4-merous

B. Leaves serrate

C. Veins on leaves arising at an angle of about 45° or more to midrib ; capsule wings 2-5 mm. long, attached towards base of capsule, usually directed backwards when young

D. Leaves long acuminate ; infl. 7-15-fl.

(i) Leaves oblong to lanceolate

169. *frigidus* Wall.

(ii) Leaves linear to linear-oblong

169. *frigidus* var. *elongatus* Cowan et Cowan

(iii) Leaves wide elliptic, obovate to oblanceolate

169. *frigidus* var. *wardii* (W. W. Sm.) Blakelock

DD. Leaves shortly acuminate, acute or rounded ; infl. 3-7-fl. ; sub-shrub 0.3-0.9 m. high, branching and rooting at the base

170. *pygmaeus* W. W. Sm.

CC. Veins usually arising at a more acute angle to midrib ; capsule wings 3-12 mm. long, attached more towards the middle of the capsule and usually directed laterally or forwards when young

E. Capsule wings 3-5 mm. long, rounded ; infl. 7-12-fl. ; fls. 2-3 mm. diam. across sepals

171. *cornutoides* Loes.

EE. Capsule wings 7-13 mm. long, tapering ; infl. usually 3-fl. ; fls. 4-6 mm. in diam. across sepals

172. *cornutus* Hemsl.

- CCC. Veins on leaves arising at an angle of 45° or more to midrib ; leaf serration finer ; capsule wings 10–15 mm. long attached about the middle of the capsule and directed laterally
 148. *latifolius* (L.) Mill f. *sempervirens* (Rupr.) E. Busch.
- BB. Leaves entire
 173. *kweichowensis* Wang
- AA. Flowers 5-merous
 F. Leaves serrate almost to base
 G. Leaves linear-lanceolate, long acuminate, as in *E. cornutus* except for 5-merous flowers ; capsule wings 7–13 mm. long, tapering
 172. *cornutus* var. *quinquecornutus* (Comb.) Blakelock.
- GG. Leaves oblong or elliptic-oblong, rarely obovate-oblong, abruptly and narrowly acuminate ; capsule wings 10–12 mm. long 2.5 mm. wide, apex subrotundate
 182. *szechuanensis* Wang
- GGG. Leaves oblong or elliptic, acute or shortly acuminate ; capsule wings to 10 mm. long, rounded
 148. *latifolius* Scop. var. *sempervirens* (Rupr.) E. Busch.
- FF. Leaves entire or entire in lower half
 H. Leaves lanceolate or oblong, veins scarcely prominent and not reticulate above, prominent and reticulate below ; capsule with rounded wings 2–5 mm. long
 174. *rehderianus* Loes.
- HH. Leaves oblong to ovate, veins scarcely prominent but reticulate above, prominent and reticulate below ; only immature capsule known, but wings will probably be longer
 175. *assamicus* Blakelock.

SERIES 14. CORNUTI (LOES.) STAT. NOV.

A more detailed account of this Series has been given in Kew Bull. 237–244 (1948).

169. **E. frigidus** Wall. ex Roxb. Fl. Ind. ed. Carey **2**, 409 (1824).
 E. Himalaya, N. Assam, Upper Burma, China (Yunnan).
 var. **typicus** Blakelock in Kew Bull. 238 (1948) (*E. burmanicus* Merrill). E. Himalaya, N. Assam, Upper Burma.
 var. **elongatus** Cowan et Cowan Trees of N. Bengal 35 (1929).
 E. Himalaya, N. Assam.
 var. **wardii** (W. W. Sm.) Blakelock l.c. 239. Assam, Upper Burma, China (Yunnan).
170. **E. pygmaeus** W. W. Sm. in Notes R. Bot. Gard. Edinb. **10**, 35 (1917). (*E. taliensis* auct. non Loes.). N. Assam, China (Yunnan).
171. **E. cornutoides** Loes. in Notes R. Bot. Gard. Edinb. **8**, 2 (1913) et **7**, 193 (1912). China (Yunnan), N. Assam, S.E. Tibet, Upper Burma.

172. **E. cornutus** Hemsl. in Kew Bull. 209 (1893). China (Hupeh, Shensi, Yunnan, Szechwan).
 var. **typicus** Blakelock l.c. 240. China (Hupeh, Yunnan, Szechwan).
 var. **quinquecornutus** (Comb.) Blakelock l.c. 241. China (Hupeh, Shensi, Szechwan).
 173. **E. kweichowensis** Wang (*E. integrifolius* Blakelock l.c. 242) in Chinese Journ. Bot. **1**, 51 (1936). China (Kweichow).
 174. **E. rehderianus** Loes. ex Sargent Pl. Wilson **1**, 488 (1913) (*E. bicolor* Lévl., *E. proteus* Lévl. teste Loes.). China (Szechwan, Kweichow).
 175. **E. assamicus** Blakelock l.c. 242. N. Assam.

Probably in this series :

176. **E. roseoperulatus** Loes. in Notes R. Bot. Gard. Edinb. **8**, 1 (1913) et **7**, 266 (1912). China (Yunnan). No flowers nor fruits.

E. ceratophorus Loes. in Pflanzenf. **20B**, 120 (1942) e descr. This is compared with *E. cornutoides* and described as "mit breiteren, lanzettlichen oder elliptischen bis länglichen Blättern mit unterseits deutlicherer netzadriger Nervatur und lockeren zweimal getabelten, lang gestielten Blütenständen ; diese beiden ebenfalls in Zentralchina".

INCERTAE SEDIS.

- alternifolius* Moench. N. America.
dolichophyllus Koidz. Japan.
dorsicostatus Nakai. Japan.
eberhardtii Tardieu. Tonkin (differs from the rest of the genus in having stiff bristles on the anthers).
effusus Vis.
elaeodendroides Loes. et var. *pleurostylioides* Loes. Madagascar.
flavescens Nakai (1942). Japan.
garcinioides Kurz. Burma.
lacerus Buch.-Ham.
lanceolatus Yatabé. Japan.
longifolius Medic.
michoacanensis Sesse et Moc. (syn. *lanceolatus* Sessé et Moc.) Mexico.
nakamurai Makino. Japan.
sumatranus Merr. Sumatra.
tsui Merr. China (Kwantung).

NOMINA NUDA

- amurensis* Hort (*E. alatus* (Thunb.) Regel.).
citrifolius Hort.
grandis Pallas.
grosseserata Hayata.
leucocarpus Boj.
linifolius Hort. ex Lavalée (*E. nanus* M.B.).
maackioides Nakai.
majumi Siebold.

marschallianus Andrz.
myrtoides Boj.
nepalensis Hort.
pseudoradicans Nakai.
punctatus Wall.
purpureus Hort. ex Lavallée.
quinquecornutus Evans.
verrucosus L. ex Jackson.
virginicus Bellardi.

EXCLUDED SPECIES.

adenophorus Scort. ex King = *Solenospermum oblongifolium* (King) Loes. in Notizbl. Bot. Gart. Berlin **13**, 225 (1936).
auriculatus Craib. The shape of the calyx and bases of the leaves are very different from any species of *Euonymus*.
calocarpus Kurz. = *Glyptopetalum calocarpum* (Kurz) Prain in Journ. As. Soc. Bengal **60**, II, 209 (1891).
calypttratus Pierre = *Glyptopetalum calypttratum* Pierre in Lecomte Flor. Gén. d'Ind-Chine **1**, 886 (1911).
capillaceus Wall. = *Microtropis bivalvis* Wall., Lawson ex Hook. f. Fl. Brit. Ind. **1**, 614 (1875).
celebicus Koord. = *Lophopetalum celebicum* Koord. Syst. Verz. z. Herb. Koord. abt. III, 73 (1910-13).
chaudocensis Pierre = *Glyptopetalum chaudocense* Pierre in Lecomte Flor. Gén. d'Ind.-Chine **1**, 865 (1911).
chinensis Lour. e descr. Leaves three-lobed, stem herbaceous etc.
colpoon L. = *Cassine capensis* L. var. *colpoon* DC. Prodr. **2**, 12 (1825) ; Harvey et Sonder Fl. Cap. **1**, 466 (1859-60).
colpoon Lam. = *Osyris abyssinica* Hochst., Harvey et Sonder l.c. **5**, sect. II, 208 (1925).
cuneifolius Wright = *Maytenus cuneifolius* Griseb. Cat. Pl. Cub. 54 (1866).
enantiophyllus (Donn. Sm.) Lundell = *Maytenus enantiophyllus* Donn. Sm. e descr. Capsule 2-3-locular.
erythrocarpus Lévl. = *Echinocarpus erythrocarpus* Lévl. in Fedde, Rep. Sp. Nov. **10**, 474 (1912) et Fl. Kouy-Tchéou 72 (1914-5).
euphlebiphyllus Hayata = *Celastrus euphlebiphyllus* (Hay.) Makino et Nemoto Fl. Jap. 678 (1931).
filiformis Wall. = *Microtropis filiformis* (Wall.) King in Journ. R. As. Soc. Bengal **65**, 342 (1896).
fimbriatus Baill. = *Lophopetalum fimbriatum* Wight, Laness Pl. util. Colon. Franc. 312 (1886).
garcinifolius Roxb. = *Microtropis discolor* Wall. ; Lawson ex Hoch. f. Fl. Brit. Ind. **1**, 614 (1875).
gibbiflora Maack = *Lonicera chrysantha* Turcz. ; Trautv. Act. Hort. Petrop. **8**, 187 (1883) ; Schneider Ill. Handb. Laubh. **2**, 722 (1912).
godaverensis Haines = *Pleurostylia wightii* Wight et Arn.
gracilipes Pierre = *Glyptopetalum gracilipes* Pierre ex Lecomte Flor. Gén. d'Ind.-Chine **1**, 864 (1911).
grossus Wall. = *Elaeodendron glaucum* Pers., Lawson ex Hook. f. Flor. Brit. Ind. **1**, 623 (1875).
harmandianus Pierre = *Glyptopetalum harmandianum* Pierre in Lecomte Fl. Gén. Ind.-Chine **1**, 868 (1911).

- hypoleucus* Lévl.=Euphorbiaceae t. Loes. in Ber. Deutsch. Bot. Ges. **32**, 541 (1914).
- inermis* Forsk. Fl. Aegypt. Arab. 204 (1775)=*Ochna inermis* (Forsk) Schwf. Arab. Pfl. nam. 148 (1912).
- laetus* Wall.=*Microtropis filiformis* (Wall.) King in Journ. R. As. Soc. Bengal **65**, 342 (1896).
- longipedicellatus* Merrill et Chun=*Glyptopetalum*?
- marivelensis* Elmer=*Glyptopetalum marivelense* (Elmer) Merr. in Philipp. Journ. Sci. **10**, 321 (1915).
- mamillaris* Scort.=*Lophopetalum scortechinii* King in Journ. As. Soc. Beng. **65**, 350 (1896).
- matsudai* Hayata=*Glyptopetalum matsudai* (Hayata) Nakai in Journ. Jap. Bot. **17**, 619 (1941). Hayata's fig. is "mala non rite" t. Nakai. Hou in Taiwanica **1**, 184 (1950) regards it as an *Euonymus*.
- morrisonensis* Kanehira et Sasaki e descr. Capsule 3-4-locular, ovary not half-embedded in disc.
- ovatus* Wall.=*Lophopetalum fimbriatum* Wight, Lawson ex Hook. f. Fl. Brit. Ind. **1**, 615 (1875).
- pallidifolius* Hayata e descr. Capsules 3-locular.
- parviflorus* Hemsl.=*Microtropis parviflora* (Hemsl.) Sprague in Kew Bull. 363 (1909); *Rhacoma parviflora* (Hemsl.) Lundell in Am. Midl. Nat. **20**, 238 (1938).
- pinnatus* Mill.=*Trichilia hirta* L., Fawcett et Rendle Fl. Jam. **4**, II, 210 (1920).
- provicarii* Lévl.=*Pittosporum truncatum* E. Pritzel t. Rehder in Journ. Arn. Arb. **12**, 280 (1931).
- pseudovagans* Pitard e descr. Capsule 2-3-locular.
- rigidus* Walp. sphalm.=*Gymnosporia wallichiana* Spreng, Lawson in Hook. f. Fl. Brit. Ind. **1**, 621 (1875).
- scandens* E. H. L. Krause=*Celastrus scandens* L.
- sclerocarpus* Kurz=*Glyptopetalum sclerocarpum* (Kurz) Prain in Journ. As. Soc. Bengal **60**, 210 (1891).
- spinous* Griffith e descr. Capsule 3-lobed=*Gymnosporia royleana* Wall.?
- stixifolius* Pierre=*Glyptopetalum stixifolius* Pierre in Lecomte Flor. Gén. d'Ind.-Chine **1**, 867 (1911).
- tina* Buch.-Ham.=*Elaeodendron glaucum* Pers., Lawson in Hook. f. Fl. Brit. Ind. **1**, 623 (1875).
- tobira* Thunb.=*Pittosporum tobira* Ait. Hort. Kew ed. 2, **2**, 27 (1811).
- viburnifolius* (Juss.) Merr. p.p.=*Elaeodendron viburnifolium* (Juss.) Merr. in Philipp. Journ. Sci. **16**, 449 (1920) et Enum. Philipp. Pl. **2**, 484 (1923).
- yunnanensis* Lévl. non Franch.=*Gymnosporia acuminata* Hook. f., Rehder in Journ. Arn. Arb. **14**, 251 (1923).

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A NEW NAME FOR A COMMON AFRICAN RHUS.

R. D. MEIKLE.

***Rhus vulgaris* Meikle**, sp. nov., *R. longipedi* Engl. affinis, sed ramulis, foliis et inflorescentiis iuventute dense villosis, nec maturitate glabris; foliolorum lamina supra haud nitida, subtus valde nervosa, floribus masculis in glomerulis aggregatis, facile distinguenda.

[*R. pyroides* (non Burch.) A. Rich., Tent. Fl. Abyss., 2, 145 (1847)].

[*R. villosa* (non Linn. f.) Oliv. in Fl. Trop. Afr., 1, 439 (1868) *pro parte*; Engl. in DC., Mon. Phan., 4, 424 (1883) *pro parte*, also in Pflanz. Afrik., 3, 2, 209 (1921) *pro parte*.]

[*R. villosa* (non Linn. f.) Engl. var. *cuneifoliolata* Engl., Pflanz. Afrik., 3, 2, 209 (1921).]

[*R. incana* (non Mill.) Robyns, Fl. Sperm. Parc Nat. Albert, 1, 489 (1948); Brenan, Check-list Trees and Shrubs, Tanganyika Territory, 5, part 2, 37 (1949) *pro parte*.]

Frutex vel arbor parva usque 10 m. alta, multiramosa. Rami brunnei vel fusci, leviter villosi, ramulis juvenilibus dense cinereo-vel brunneo-villosis, sparse lenticellatis. Petioli circiter 2–3 cm. longi (raro usque 6 cm. longi) subteretes vel parte superiore leviter canaliculati,

dense villosi. Folia trifoliolata, utrinque juventute molliter villosa maturitate pubescentia, siccitate pallide brunnea vel olivacea ; foliola media plerumque 4.5 cm. longa et 3.5 cm. lata, nonnunquam 10 cm. longa et 6.5 cm. lata, obovata vel rotundata, basin versus cuneata, apice obtusa mucronulata vel rarissime emarginata, marginibus apicem versus saepe undulato-crenatis, raro integris vel grosse serratis, nervi laterales circiter 10-12, cum costis supra leviter impressi, subtus valde prominentes, dense pubescentes ; foliola lateralia mediis similia, sed iis paullo minora et basin versus abruptius angustata. Inflorescentia terminalis vel subterminalis, basin versus foliosa, in parte superiore nuda, pyramidalis, laxa, multiramosa, usque 20 cm. longa vel longiora ; rhachis et ramuli dense pubescentes. Flores masculi in glomerulis densis, subsessilibus, secundum inflorescentiam elongatam aggregati, sepala 5, circiter 0.5 mm. longa et 0.3 mm. lata, ovata, subacuta, obscure nervosa, sparse villosa ; petala 5 circiter 1 mm. longa et 0.5 mm. lata, ovata, obtusa, raro subacuta, obscure costata, glabra, filamenta valde applanata, usque 0.75 mm. longa ; antherae circiter 0.3 mm. longae et 0.2 mm. latae ; discus circiter 0.2 mm. latus, margine valde crenulatus. Flores feminei laxe paniculati, haud glomerulati, sepala et petala iis florum masculorum similia ; antherae minutae ; abortivae ; discus valde crenulatus ; ovarium subglobosum, diametro 0.5 mm., glabrum ; stigmata 3, stylis brevissimis valde recurvatis. Fructus maturus globosus circiter 5 mm. diametro, siccitate valde compressus, carnosus, ruber, brunneus vel rubescens.

FRENCH CONGO. Between Buar and Buala, 1914, *Mildbraed* 9543 ; Bosum, 1914, *Tessmann* 2263.

BELGIAN CONGO. District forestier central : Mulungu, 1940, *Hendrickx* 1442 ; District des lacs Edouard et Kivu : Katana, 1940, *Hendrickx* 1494.

ANGLO-EGYPTIAN SUDAN. Yei River : Lado, comm. 1919, *Sillitoe* 244 ; Jebel Marra, ca. 1950 m. alt., 1921, *Lynes* 60, 96 ; Didinga hills, Naligede, 1740 m. alt., 1939, *Myers* 10983 ; Imatong Mts., 1380 m. alt., 1949, *Andrews* A.1823.

ABYSSINIA. Near "Mt. Schoata," 1842, *Schimper* 1339, also *Schimper* 1593, 246 and 1163 ; "Djenda" in Dembea, 1862, *Steudner* 618 ; Galla Pass, 1933, *Gillett* 5204.

UGANDA. Bunyoro District : Budongo Forest, 1400 m. alt., 1925, *Brasnett* 99 ; Ankole District : Ibanda Hill, 2000 m. alt., 1929, *Snowden* 1395 ; Acholi District : Gulu, 1935, *Eggeling* 1640 ; Karamoja District : Mt. Debasien, 1460 m. alt., 1937, *A. S. Thomas* 2204A ; Acholi District : Imatong Mts., 2600 m. alt., 1938, *Eggeling* 3569.

KENYA. North Nyeri District : Mt. Kenya, near Forest Station, 2300 m. alt., 1921, *R. E. & T. C. E. Fries* 554 ; ? North Kavirondo District : south-east slopes of Mt. Elgon, 2200-2500 m. alt., 1931, *E. J. Lugard* 326A ; Naivasha District : Mt. Kinangop, 2100-2400 m. alt., 1933, *Albrechtsen* in *Coryndon Mus.* 5125 ; Nandi District : Kaimosi. N. of Yala River, 1933, *Rogers* 711 (*type of species*) ; ? Machakos District : Chyulu hills, 1560 m. alt., 1938, *Bally* 7961.

RUANDA-URUNDI. Kibungu, Ngataro hill, 1942, *German* 1470.

TANGANYIKA. Kondo District : Kandaga, 1500 m. alt., 1928, *Burt* 1107 ; Bukoba District : Bugene, 1500 m. alt., 1931, *Haarer* 2286 ; Mwanza District : Mwanza and Ukerewe, 1932, *Rounce* 66 ; Lushoto District : Kongei, 1110 m. alt., 1933, *Greenway* 3348 ; Morogoro District : Uluguru Mts., Bunduki, 1380 m. alt., 1934, *E. M. Bruce* 464.

Schonland (*Bothalia*, **3**, 19 : 1930) has very rightly drawn attention to the fact that the great mass of Tropical African material labelled *R. incana* Mill. or *R. villosa* Linn. f. is not identical with authentic material of this species from South Africa. The matter is further complicated by the fact that at least two very common Tropical African species have been jointly misidentified under one or other of these names. One of these is, I think, *R. longipes* Engl. (*R. ruzizensis* Engl.) but I cannot find a name for the second, and am consequently obliged to describe it as a new species. The features distinguishing *R. vulgaris* from *R. longipes* are given above—I may add that the leaves of the former never assume on drying the rich, chocolate-brown colour which is so characteristic of *R. longipes* ; the nervation and indumentum of the leaflets, and the inflorescence structure, are also distinctive, and, in practice there is rarely any difficulty in naming the two plants. Both have a wide distribution, but whereas *R. longipes* is found almost throughout the tropical area, *R. vulgaris* is apparently absent from West and South Tropical Africa. *R. vulgaris* and *R. longipes* differ from genuine *R. incana* Mill. (*R. villosa* Linn. f.) in having larger chartaceous (not subcoriaceous) leaflets, obscurely reticulate venation, and ample, laxly-branched inflorescences. There are probably other, and perhaps more obvious, distinctions in the habit of the species, but such information can only be obtained from study in the field. Collectors are especially requested to be generous with notes when collecting *Rhus* ; as it is obvious that many characters of considerable taxonomic value are lost in dried material.

The numerous varieties of “*Rhus villosa*” or “*R. incana*”, described by Engler and others, are of very doubtful value ; some represent typical forms of *R. vulgaris* (e.g. var. *cuneifoliolata* Engl.), others must be referred to *R. longipes* (e.g. var. *grandifolia* Oliv. and var. *usambarensis* Engl.) or to distinct species (e.g. vars. *gracilis* Engl., *obtusata* Engl. and *dahomensis* Hutch. and J. M. Dalz.). I have not seen authentic material of vars. *dentata* Engl., *crenato-serrata* Engl., *massaiensis* Engl., *Dekindtiana* Engl., or *gallaensis* Engl., but feel satisfied that the majority of these fall within the limits of *R. vulgaris* or *R. longipes* and that none should remain as varieties of true *R. incana* Mill. (*R. villosa* Linn. f.). Var. *tomentosa* Oliv. (Fl. Trop. Afr. **1**, 439 : 1868) has perhaps a better claim to be considered distinct, but such densely villose, large-leaved varieties merge with typical *R. vulgaris*, have no distinct geographical distribution, and, so far as can be judged, are present in most populations of the species, so I have refrained from making the necessary *comb. nov.* Other forms of *R. vulgaris* are deceptively like *R. ruspolii* Engl. (*R. bequaertii* Robyns and Lawalrée), but this is, in fact, quite a distinct species, and cannot be confused with *vulgaris* when fruits or flowers are present.

Following a suggestion put forward by Schonland (*Bothalia*, **3**, 25, 1930), Dr. R. Pichi-Sermolli has recently (Miss. Stud. Lago Tana, **7** (1) 78, 1951) cited, under the name *R. macowani* Schonl., a number of Abyssinian specimens which, I suspect, belong to my *R. vulgaris*, though

I have not yet had an opportunity to examine Dr. Pichi-Sermolli's material.

True *R. macowani* Schönl. is, I believe, confined to southern, sub-tropical Africa, and differs from *R. vulgaris* in leaf-shape, size and indumentum, and especially in its nebulous, many-flowered male inflorescences. The male flowers are not glomerulate as in *R. vulgaris*; and the distributions of the two species seem distinct.

A NEW COMBINATION IN OTOSTYLIS SCHLECHT.

Otostylis alba (Ridl.) Summerhayes, comb. nov.

Aganisia alba Ridl. in Timehri, **5**, 167, 204 (1886).

Zygopetalum venustum Ridl. in Trans. Linn. Soc. Lond. Bot. ser. 2, **2**, 283 (1887).

Otostylis venusta (Ridl.) Schltr. in Orchis, **12**, 41 (1918).

When he proposed the new genus *Otostylis* Schlechter adopted the trivial *venusta* for this species, presumably because he thought that Ridley's *Aganisia alba* was merely a *nomen nudum*. He was clearly unaware of the excellent description in Timehri. It appears that Ridley changed the name of this species when the account of Im Thurn's Roraima plants was published in the Transactions of the Linnean Society, substituting the trivial "venustum" for the previously published "alba". The correct name for the species in *Otostylis* is that given above.

V. S. SUMMERHAYES.

MARINE ALGAE FROM THE GOLD COAST: III*

C. I. DICKINSON.

In this particular collection (see K.B. No. 2, 1950) the following two species described for the first time are solitary representatives of their respective genera.

Dictyurus fenestratus Dickinson, sp. nov. Basis rhizomatosa. Frondes erectae, plerumque circiter 6 cm. sed usque 8 cm. altae, usque sesquies ramosae. Axis teres, cellulis pericentralibus 4 corticem crassum efficientibus. Rami parte superiore (2-4 cm.) velo spirali partim aperto (e ramulis distichis et alternis efformato) induti. Velum compressum, margine libero dentes paucos breves gerente, cellulis marginis exterioris partis clausae spirae dentes paucos magnos usque 6-cellulatos gerentibus. A ceteris speciebus velo compresso semi-aperto differt. Corpora reproductiva ignota.

GOLD COAST. Prampram. Jan. '46, Nov. '48, March '50. Typus in Herb. Kew.

Forming cushions on the overhanging parts of large rocks in the Outer Zone.

A new species of *Dictyurus* amongst the algae collected by Miss V. J. Foote is a most interesting discovery. It is extraordinary that in this genus

*Continued from Kew Bulletin 1951, No. 1 (1951).

founded in 1836 on a specimen from the southernmost point of India, only one other species has been described and that as long ago as 1847. The second was from Mexico and until quite recently there was no link between these two species, the one in the Indian Ocean and the other in the Western Atlantic. However, in 1938 Dr. J. Feldmann recorded the Mexican species from Senegal. The appearance of this record together with the fact that I had not seen a *Dictyurus* except as rather poor dried herbarium specimens from which it was difficult to reconstruct the plant, caused me to hesitate over what is really a very distinct species.

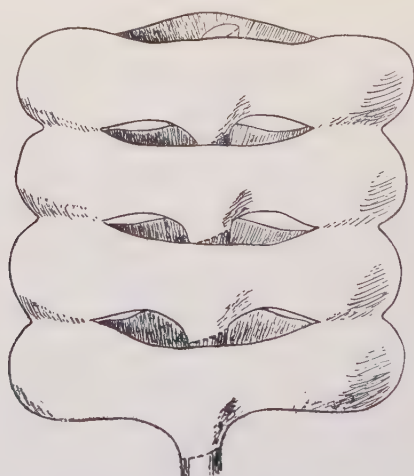
With the help of Dr. R. W. G. Dennis attempts were made to get material from the West Indian region, but these were unsuccessful. Knowing Dr. Boergesen to be familiar with *D. occidentalis* a specimen of the Gold Coast plant was sent to him asking if he had seen anything like it in the West Indian flora. He replied "Regarding the specimen of *Dictyurus* I have not among my West Indian specimens found any like yours ; but most interesting I have a single specimen from Senegal which Feldmann has sent me several years ago, and this seems to agree very well with yours ; I enclose a small bit of it for your inspection".

An examination of the Senegal plant after soaking shows it to belong to the same species as those from the Gold Coast.

I should like to point out that Dr. Feldmann's record did not appear in one of his algological studies but was incidental to some work on marine phanerogams.

To add to the peculiar record of this long established genus, the sexual organs were unknown until described by Svedelius in 1946. The Gold Coast specimens are without reproductive bodies of any kind but as they were all collected between November and March it is probable that these will yet be found.

The vegetative characters are those of a *Dictyurus* ; the branching is sympodial, the axis is terete with 4 pericentral cells developing a thick cortex and is enclosed in a spiral veil which gradually drops off from below upwards leaving its remnants on the lower part of the axis.

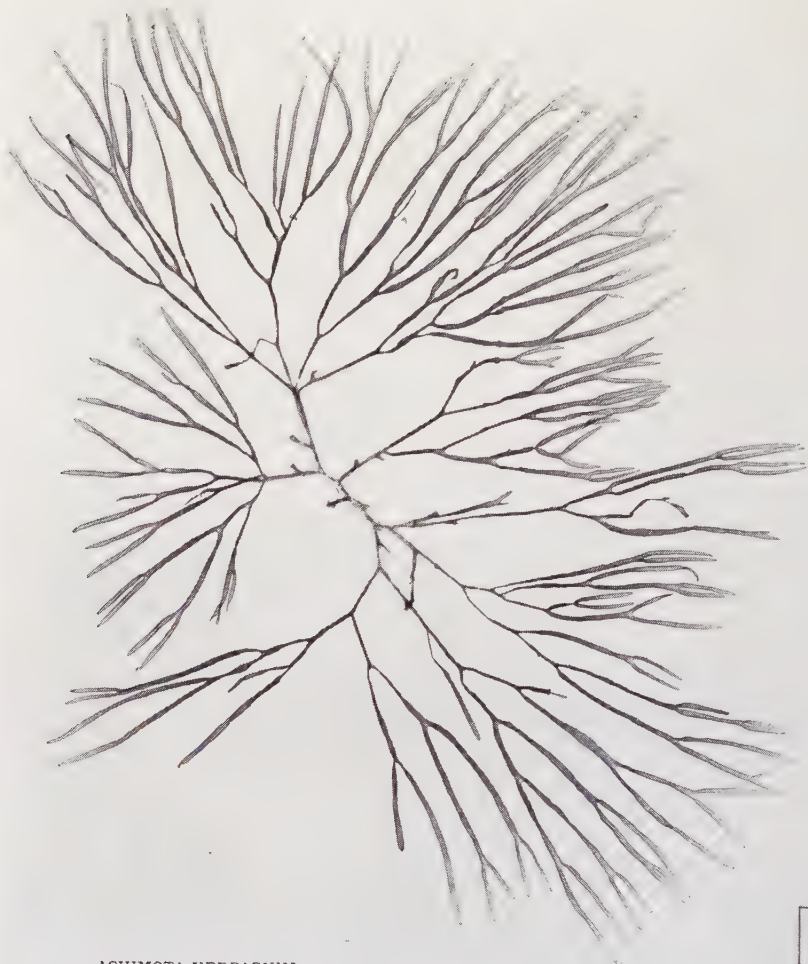


Dictyurus fenestratus Dickinson.
Diagrammatic representation of a part of the frond.

PLATE 3.



Dictyurus fenestratus Dickinson.



ACHIMOTA HERBARIUM

Botanical Name *Scinaia*

Natural Order

Vernacular Name

Use

Native Name *Pham Nam* Collected by V. J. Forde

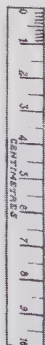
Remarks From sandy pool
below other large rocks.

Date 19/1/46

Number 326

HERB. HORT. BOT. REG. KEW.

Gloiophloea verae Dickinson



Gloiophloea verae Dickinson.

This species differs so markedly from the other two in the first place in having the veil arranged about axes of different length so that the veiled part of the frond is compressed and secondly in having the network in the form of a partially open spiral. The free edges of the net stand out from the axis as very ornamental fan-shaped structures.

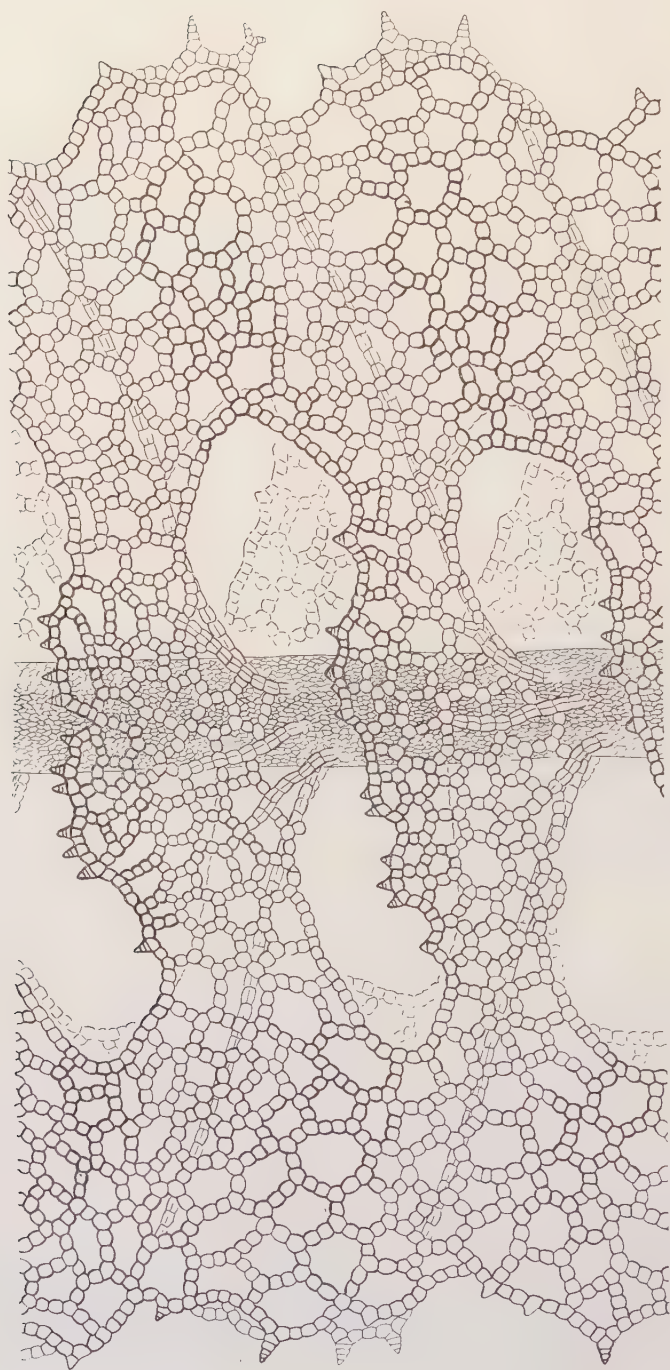
Dictyurus apparently will not endure much exposure, for all three species occur either completely submerged or in such a position that they are shaded and submerged most of the time.

Gloiophloea verae Dickinson, sp. nov. Plantae 15–20 cm. altae, e basi disciformi circiter 3 mm. diametro exortae; thallus teres, apice attenuatus, inferne 1 mm. diametro, superne usque 2.75 mm. diametro, ramis superioribus 2–4 (raro 5) cm. inter se distantibus. Cortex utriculorum exterior $20\text{--}25\mu \times 35\text{--}43\mu$, seriebus anticlinalibus cellularum coloratarum circumdatus. Filum centrale circiter 270μ diametro, invisibile. Cystocarpia lageniformia $200\text{--}230\mu$ (collo incluso.) $\times 130\text{--}150\mu$. Antheridia ignota.

GOLD COAST. Prampram. Aug–Sept. '45 ♀, Jan. '49 ♀, Nov. '49 ♀; Tenpobo Feb. '50 ♀. Typus in Herb. Kew.

In sandy pools on the inner side of the Outer Zone.

This species is named after Miss Vera J. Foote who made the collection. Like other members of the group which Setchell has called the “Scinaia Assemblage” it has no striking character by which it can immediately be distinguished from its near relatives but a survey of the macroscopic and microscopic detail seems to set it apart from other species of the genus. It grows from a very small holdfast about 3 mm. in diameter and is a robust bushy plant reaching as much as 20 cm. in height. When in good condition it may be identified by its size, the long intervals between the branches, and the upward increase in the breadth of the thallus. It has been carefully compared with *G. capensis* Setchell to which it bears some resemblance in microscopic detail. Setchell says of *G. capensis* “The cortex is comparatively thin in the cystocarpic plant and noticeably thicker in the antheridial plant”, and this would have separated it from *G. verae*, but unfortunately his two illustrations belie this statement showing the antheridial plant to have the thinner cortex. Another difficulty encountered in Setchell's description is that he speaks of the cystocarps as “broadly obpyriform”, measuring $65\text{--}130\mu \times 115\text{--}150\mu$ and since in his descriptions of other species he indicates whether or not the neck is included while he omits mention of it in this case, it seemed that the neck might have to be added to produce the pyriform shape so bringing it near to *G. verae*. It became increasingly evident that it was necessary to see an authentic specimen of *G. capensis*. The only one available was at the British Museum (Natural History). This was a specimen in the Tyson collection from the mouth of the Kei river which had been vouched for by Dr. M. Martin and Dr. G. Papenfuss, both of whom have spent several years studying the algae on the shores of S. Africa. The Kei specimen has cystocarps rather larger than those described by Setchell, but the proportions are the same, that is to say they are broader than long and the neck is so short as to be hardly discernible. The South African plant agrees with Setchell's description in being about 10 or 11 cm. high. It differs from the Gold Coast plant in



Dictyurus fenestratus Dickinson.
A section from the middle of the veiled part of the frond $\times 25$.

being of a more or less even width, and in the shorter intervals (2-2.5 cm.) of the branches. The character of the cystocarp alone separates it quite definitely from *G. verae*.



Gloiophloea verae Dickinson.
Transverse section of the cortex $\times 650$.

Another species which has to be taken into account is *G. fascicularis* Boergs. Macroscopically it is a very different plant from *G. verae*. Comparison has been made with a specimen in the Kew Herbarium, and I am indebted to Dr. Boergesen for comparing it as to habit with material in his own herbarium. The cystocarps of *G. fascicularis* are similar in shape and size to those of *G. verae* but it seems that the two species can be separated not only on macroscopic differences but on the thickness of the outer cortex which in Boergesen's species is about 50μ while in *G. verae* it is nearer 80μ .

Presumably *G. verae* is dioecious as antheridia have not yet been found. All the plants are cystocarpic and it seems unlikely that the antheridia have been overlooked. On the other hand if the species is dioecious it is strange that only female plants have been collected.

PINUS CARIBAEA (SLASH PINE).

S. G. HARRISON

Pinus caribaea Morelet, as its name suggests, is native to parts of the West Indies, and the neighbouring countries of Guatemala, Honduras and the south-eastern United States. It is the last country which up till now has shown the greatest appreciation of the qualities which the tree undoubtedly possesses. It is well known that the United States produce more oleo-resins than all the other producing countries of the world put together, and as Slash and Longleaf (*Pinus palustris* Mill.) are the only two pines of major importance in this connection amongst 37 species native to the U.S.A., it can be appreciated that these two pines make a considerable contribution to world trade, in addition to the large quantities of timber and woodpulp which they also supply. At the present time, when the economic spheres of the dollar and sterling are so distinctly divided and there is a world shortage of both timber and oleo-resin, it is desirable that

the resources of the British Commonwealth should be developed to the full and that attention should be focussed upon any species likely to be of increasing importance either in its natural habitat or elsewhere. It seems probable that *P. caribaea* may exceed *P. palustris* in importance because of its capacity to succeed on poor, badly drained soils or wet sandy flats for which there are few alternative uses. In the United States, it occurs in S. Carolina, extending southward through south-eastern Georgia to the keys of Florida and westward along the Gulf Coast, through southern Alabama and southern Mississippi into south-eastern Louisiana. It is often dominant in secondary forest following the felling of *P. palustris*, but it has the reputation for growing well on soils too poor for that species to be productive. It is also said to grow more rapidly and to tolerate more competition than *P. palustris*. In Honduras, Slash Pine grows in well marked zones separated by belts of rain forest on deeper, richer soils, on northern plains and on the southern coastal plain of British Honduras, extending southwards into Nicaragua and westwards into Guatemala. In the West Indies it is native to the Bahamas, Cuba and the Isle of Pines. The species has been successfully grown in many parts of the British Commonwealth, including Zululand, Nyasaland, Cape of Good Hope, the Rhodesias, New South Wales, Queensland and Trinidad. Hitherto it appears to have been considered primarily as a source of timber in these countries, or simply as a desirable shelter-belt or shade tree and as an ornamental conifer. The possibilities of oleo-resin production are likely to stimulate increasing interest in the species whenever a dual-purpose system producing both oleo-resins and timber or wood pulp seems to be commercially attractive.

It might be noted, too, that tannin is another possible product which has been examined ⁽¹⁾ and that the suitability of young thinnings for plywood manufacture, especially for multi-ply construction, might also be considered. Slash Pine grows rapidly and may be expected to give good yields of oleo-resin after 15 to 25 years.

The tree attains a height of 90–100 ft., sometimes more, with the shapely trunk often clean for 50–70 ft. In habit it is said to resemble *Pinus taeda* L., (Loblolly Pine) when young, but at maturity the large spreading branches and rounded crown are more nearly akin to *Pinus palustris* or old specimens of *Pinus sylvestris* L. The timber is comparable with that of *P. palustris*, so much so that the two species are often mixed in trade channels, although it has been stated that *P. caribaea* produces timber which is heavier, harder and stronger than that of any other commercial conifer in the United States. ⁽²⁾ It is slightly more resinous than *P. palustris* and is believed to be fairly durable and fungus resistant but is more liable to develop dry face if chipped too heavily.

In America, at least, seed is produced annually with heavy crops occurring every 2 to 3 years. The seeds are reported to be 60% to 90% fertile and to retain their vitality very well when stored, 70% germination being recorded after 2 years in ordinary tins, whilst refrigerated seeds have germinated satisfactorily after 15 years storage. ⁽³⁾ Natural regeneration can be expected to be adequate from established stands, but despite its good standard of viability the species is not always easy to establish, even in localities which appear to be eminently suited to its cultural requirements. Germination may sometimes be sporadic and

seedlings may be weak and slow to develop. Failures in Trinidad ⁽⁴⁾ have been attributed to the absence of essential mycorrhiza from the soil; a deficiency which has been corrected by bringing top-soil from *Pinus caribaea* stands in British Honduras to be mixed with local soil in the seedbeds. It is suggested that "inoculation" of seedbeds, with a handful of soil per sq. ft. from a thriving pine plantation well infected with mycorrhizal fungi, could be tried in areas where growth of the seedlings proves to be unsatisfactory under apparently suitable conditions. Contradictory reports on various problems connected with the importance of mycorrhizal associations occur from time to time ⁽⁵⁾ and will no doubt lead to further investigations. Initial difficulties with seed germination and stunted development occurred in Queensland with both *Pinus caribaea* and *Pinus taeda* (Loblolly Pine), but the growth rates of both have since been reported to have surpassed the same species in their natural habitat and plantations yield considerable quantities of timber for the container trade after as little as 8 years growth. ⁽⁶⁾ Such results are encouraging for areas where the initial stages of establishment have been disappointing. In Zululand *P. caribaea* has been easily established and is found to grow well on swampy land, provided that the water is not stagnant. Its annual growth rate there is reported to be 5-6 ft. ⁽⁷⁾ Similarly in Nyasaland, the species is amongst the selected few which have been the subject of trials for about 20 years and are expected to be of great value for afforestation in the moister regions, although the growth and form of *Pinus caribaea* is sometimes poor on well drained hill slopes. ⁽⁸⁾ In New Zealand, *Pinus caribaea* is one of the species showing promising results in the Auckland Conservancy, but it is considered that it should be confined to sheltered lower slopes below the 400 ft. contour as a general rule. ⁽⁹⁾

If it should be decided that a plantation of *Pinus caribaea*, now or in the future, is to be exploited for oleo-resins, a number of handbooks or other publications are available which deal adequately with the general details of management of Slash Pine, including methods of resin production. It is therefore unnecessary to dwell upon the advantages or disadvantages of particular recognised systems. In recent years it has been found that resin production can be greatly increased artificially, by various stimulants. One of the older but still probably the most satisfactory methods is by the application of 40% to 60% H_2SO_4 or HCl to the cut 'face' where the resin is collected. This treatment is said to increase the yield by 20%-60%, ⁽¹⁰⁾ or even 120% ⁽¹¹⁾ without any undue effect upon the quality of the product, other than clouding of the resin by concentrations of acid exceeding 40% and some darkening in colour when 60% acid is used. ⁽¹²⁾ It has been demonstrated, by estimation of the quantities of reserve carbohydrates in the bark of the roots and stem, that commercial acid treatment does not impoverish the tree, even though the resin yield is so greatly increased. ⁽¹³⁾ An alternative which is said to give results equal to the acid method is the treatment of the faces with the morpholine salt of 2, 4-D, which has the advantage of being non-corrosive. ⁽¹⁴⁾ Another treatment which is being investigated utilizes the pitch-canker fungus, *Fusarium lateritium* f. *pini*, to prolong the flow of resin, but *Fusarium* treated faces have not produced yields so high as those obtained

with acid ⁽¹⁵⁾ & ⁽¹⁶⁾ The reason for this response to *Fusarium* is unknown and awaits investigation.

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Home Orchid Growing.*—Whereas in this country the number of private orchid cultivators has been decreasing steadily for some years, the reverse is true for the United States of America. In that country the growing of orchids in ordinary homes or in small greenhouses has become very popular and has led to the appearance of a number of books designed for the guidance of the small amateur orchid grower.

The present volume is an outstanding example of this type of book, being written in a pleasant and informal style and being profusely illustrated with numerous excellent photographs showing methods of

*Home Orchid Growing. By R. T. Northen. D. von Nostrand Company, Inc., New York, and Macmillan & Co. Ltd., London, 1950. Pp. 284, 10 colour and 112 black and white plates, 22 line drawings and diagrams. Price 45s., \$6.

cultivation and other features. There are also ten very attractive coloured plates of special orchids.

The scientific basis underlying orchid cultivation is kept to the fore throughout the book, while there are also sections on such modern matters as growing orchids from seed, the genetics of orchid hybrids and the effect of colchicine on hybrid production. Other special chapters deal with the pests which attack orchids, types of greenhouses, etc., and the use of cut flowers.

A large part of the book consists of an account of the various natural groups of orchids, and describes the better known horticultural species. This is quite well done and shows a commendable appreciation of the advances in our knowledge of the classification and nomenclature of orchids, a feature sadly lacking in some books on the family.

Altogether this is an excellent treatise for the public for which it is intended, though it is to be feared that the people who would be likely to require it in this country are very few in number. Perhaps if the public here can be persuaded to read the book they may be stimulated to see if they can succeed as well as our American friends !

V. S. SUMMERHAYES.

Cape Flowers.*—The rich phanerogamic flora of the Cape Peninsula consists of about 2,600 species. Some of them are extremely rare but few areas of the world can be floristically richer. In this book* about 814 species are illustrated in colour by four-colour process. There is no doubt that the paintings will be of great help as an aid to quick determination of many of the commoner and more conspicuous plants of the Cape Peninsula though they are of varying artistic merit. The arrangement is, as nearly as possible, on the basis of flowering period so that related plants are often widely separated one from another. In addition to a coloured figure, the name, authority, family, habit, distribution or habitat, and flowering period are given very briefly. There is an index to common names and another to the scientific names. A third so-called index is an alphabetical list to families and genera. The late Field-Marshal J. C. Smuts provides an appreciative foreword.

It is a pity that the entire flora of the Cape Peninsula could not have been illustrated. Incomplete accounts of a flora are frequently irritating in use, for the very plant one wishes to determine may not be represented and one's time in searching for it amongst illustrations or descriptions is then wasted. Another complaint may well be that the price is too high even for 94 plates in colour.

W. B. TURRILL.

*Mary Maytham Kidd : *Wild Flowers of the Cape Peninsula*, Oxford University Press, 1950. Price £3-3-0.

Systematics of the Seed Plants.*—That in the short space of twelve years a second edition of Dr. Pulle's Compendium has been called for, is a sufficient testimony to its usefulness. It is, as before, assured of a warm welcome in those countries where the Dutch language is current.

The book is divided into three sections, (1) Terminology, (2) Nomenclature, and (3) Systematics. Each of these is treated as exhaustively as is to be expected in a volume of this size. The Rules of Nomenclature are as up to date as possible, even containing Dr. Lanjouw's proposals for consideration at last year's Botanical Congress in Stockholm.

We congratulate Dr. Pulle and his publishers on a most useful and well printed volume.

*Compendium van de Terminologie, Nomenclatur en Systematiek der Zaadplanten by Dr. A. A. Pulle. N. V. A. Oosthoek's Uitgevers-Maatschappij, Utrecht. Price Guilders 9.75.

The Wild Orchids of Britain.*—This sumptuously produced volume is dedicated to the memory of the artist, who died in 1942. In the words of the author, one of his objects has been "to provide a link between the ordinary Flora and the 'specialist' literature on the subject. The book aims at being an Iconograph rather than a Monograph"; while, so far as the text is concerned, he "has admittedly addressed himself to the not-too-learned amateur of orchids, rather than to the scientific botanist". There are three short introductory chapters, two of which deal with the structure and growth of orchids, and with classification and nomenclature. Then come the detailed descriptions (in the widest sense, implying short descriptive essays) of our wild orchids. These are followed by three appendices devoted to discussions of the interpretation and nomenclature of critical forms of *Epipactis*, *Orchis simia*, and Spotted and Marsh Orchids. The text begins with a bibliography and a classified list of the British *Orchidaceae*, and concludes with a small glossary.

So long as Mr. Brooke is seeking to give pleasure and general instruction to amateurs, he is very good indeed, because he has observed keenly and read quite widely; above all, he is a literary artist who easily captivates us with what Lytton Strachey called the magic spices of words. In his descriptive accounts he now and then hits the bull's eye with a memorable phrase, for instance, the "ragged-looking spike" of the Lizard Orchid, or the "spiky-looking" flower of *Liparis*. The treatments are rather unequal, perhaps because he has not himself seen all the species, or because his love for some of them is neither deep nor true. *Leucorchis albida* and *Listera cordata* are dismissed very summarily, and one is surprised that the Fly Orchid has not caught the fancy of this writer. *Gymnadenia densiflora* and *Ophrys trollii* are accepted as full species, but the northern Irish Lady's Tresses is treated as a variety *stricta* of *Spiranthes*

*The Wild Orchids of Britain. By Jocelyn Brooke, with drawings from the living plant by Gavin Bone, and additional drawings by Muirhead and Stephen Bone. The Bodley Head, London, 1950, pp. 139, pl. 40 (seven-colour lithography). Price £8 8s.; 40 signed and specially bound copies, £10 10s.

romanzoffiana. Otherwise, the species-standard is more or less that of Prof. Clapham's "Check list of British vascular plants", but the nomenclature is often at variance with the International Rules.

Mr. Brooke is less happy in his rôle of medium between amateur and scientific botanist. These predigested discussions of intricate questions are certainly well-informed, but the vein of superficiality and inconsequential naïveté which runs through them betrays a lack of scientific discipline: little more is achieved than a perilously near and perhaps wistful approach to the ranks of those whom he airily dubs "rival pedants". Was it wise, one wonders, in such a book, to print those appendices which, in fact, attempt the impossible, a sort of Wilmott, Druce and Pugsley Without Tears which may impress those *dilettanti* who can afford to buy it but may bore and confuse those beginners who will borrow it? Mr. Brooke seems unaware of the publication of *Neotinea intacta* var. *straminea* Pugsl. and *Orchis morio* var. *churchillii* Druce, whatever their value may be; and he also omits *Epipactis cleistogama* C. Thomas, which was recently described in a County Flora. One very obvious flaw in Appendix A is the description of three varieties new to science, all of them untypified and unlocalised. Mr. Brooke's chief botanical adviser should have saved him from this. The dual nature of this book, then, makes it an interesting curiosity, but the remark of one Sunday reviewer, that it will be the standard work on the subject, invites an indulgent smile from the more initiated.

The paintings, which are the *raison d'être* of the volume, are executed with an individual freedom and vitality which prevent them, at least in reproduction, from giving complete satisfaction as faithful illustrations of British orchids. Many of them have the unfinished look of much "line-and-wash". Some of the plates of Marsh and Spotted Orchids, and those of *Aceras*, *Neottia*, *Orchis purpurea* and *Epipactis vectensis*, may be singled out for their vision of truth and beauty, and many others will give much pleasure, according to taste. We have all seen that gross, *fanée*, Pyramidal Orchid, which was an excellent idea, but the colouring of the two younger specimens is very disappointing. Plate 3 (*Cephalanthera ensifolia*) is fashionably disturbing, rather than beautiful: the two specimens are "all in a flap" or, in contemporary claptrap, "afflicted with *Angst*". One of the loveliest things in the book is Sir Muirhead Bone's Monkey Orchid, a painting which has been spared the inked outlines which are so noticeable in the others.

N. Y. SANDWITH.

The Physiology of Fungi.*—Miss Hawker's book gives a useful summary of research on an aspect of mycology which has hitherto been inadequately treated in English textbooks. It should find a ready sale amongst the University students to whom it is primarily addressed. In a second edition opportunity may well be taken to expand some of the chapters, for the book as it stands is somewhat unbalanced. Thus in

*The Physiology of Fungi, by L. E. Hawker, University of London Press. xiv + 360 pp. Price 21/-.

chapter 2 on growth and variation it is odd to find no reference to Bisby's record of the remarkable longevity of *Schizophyllum* sporophores. It would have been well, too, to sound a critical note when discussing claims of mutant induction by exposure of fungus cultures to high temperatures. Thom and Raper have shown that of Barne's 6 alleged heat-induced mutants of *Euotium hebariorum* 1 scarcely differed from the parent strain, 4 were common laboratory contaminants and the 6th, though a probable mutant, was of the *Cladosarum* type which has occurred sporadically in non-heated *Aspergillus* cultures. Chapters 3, 4 and 5 dealing with fungus nutrition form the core of the book and here Miss Hawker is on familiar ground. Curiously, there is no reference to Lindeberg's extensive studies on the utilisation of lignin and cellulose by species of *Marasmius*. Lindeberg's work is also of value in showing that zinc is an essential element for basidiomycetes as well as moulds. Mention might also profitably be made of Karling's keratinophilic chytrids. Chapters 6 and 7 deal with the influence of non-nutritional factors on growth, sporulation and spore germination. Chapter 8 attempts to cover in 53 pages the whole field of "interaction with other organisms", including parasitism, mycorrhizae, lichens, antibiotics, and the complex inter-relationships of fungi and insects. This is obviously absurd and the chapter could well have been omitted or expanded to form a companion volume.

R. W. G. DENNIS.

Plant Infection.*—Professor Gaumann's monumental Pflanzliche Infektionslehre was published in 1946 and must ere now have become familiar to all plant pathologists, at least by repute. At this late date it is hardly necessary to criticise his accomplishment in detail; the prospective purchaser of the English edition, ruefully counting out his sixty-three shillings, will ask merely to be assured that the translation is accurate and unbiased. It is unfortunate, then, that when he opens the book he finds a concise half page of author's preface followed by over five pages of turgid prose signed by the English editor. Surely the worst has happened, Gaumann has been smothered by a surfeit of Brierley? If he perseveres he will discover there has been no such disaster. Comparison of the text shows the English rendering to be both felicitous and trustworthy, even such monstrous coinage as hydrochory and anthrochory is Gaumann's own, faithfully preserved by the translators to startle English eyes. This is a book which every plant pathologist should read.

R. W. G. DENNIS.

*Principles of Plant Infection. E. Gaumann, English edition by W. B. Brierley. xvi + 543 pp. Crosby Lockwood & Son Ltd., London, 1950. £3-3-0.

Poisonous Plants of India.*—Many will welcome the appearance of this comprehensive work on the poisonous plants of the Indian Sub-continent, especially as the existing literature on the subject is so widely scattered. As the authors point out in their preface the work was actually initiated in 1935 by the Imperial (now Indian) Council of Agricultural Research. Over 3,000 circulars and questionnaires were issued to various Government departments, universities and private individuals and extensive tours undertaken all over India. It is apparent from the nature of the book and the extensive bibliographies that the authors have made a very thorough study of the subject and have incorporated a good deal of new information in the work.

The first hundred pages or so of this, the first volume, are devoted to introductory matter and general aspects of the subject are dealt with such as :—the history and definition of poisonous plants, their toxic constituents, action, symptoms and diagnosis, factors determining toxicity and various economic and pharmacological aspects.

The rest of the volume deals systematically with all the known poisonous plants of India (and Pakistan). In addition to the indigenous species many introduced or naturalised plants are included. The arrangement of the families is according to Bentham and Hooker's system. Under each family brief general notes are given on the main botanical characteristics of the family and on the toxic and economic aspects of the more important poisonous species in the family, irrespective of whether they are Indian or not. A detailed treatment of the Indian species then follows. Where known the chemical constituents, physiological action and methods of treatment and prevention of poisoning are discussed. In some families keys for the identification of genera or species are given but some may doubt whether they are likely to serve a useful purpose in a work of this kind.

In the first family to be considered, the *Ranunculaceae*, the Indian aconites (*Aconitum* spp.), renowned for their extremely poisonous nature and their use in arrow poisons, are dealt with. Fourteen species are discussed. Some readers may be surprised to see that certain important food crops or economic plants such as the potato, coffee and tea find a place in the book. However, although such plants are normally harmless, under certain conditions, as in excess, they may prove harmful or toxic.

The present volume deals with the families up to and including the *Convolvulaceae*. The remaining families are to be dealt with in the second volume—said to be awaiting publication. The authors point out there is much to be investigated with regard to the chemical constituents and effects of the poisonous plants of India. Nevertheless their work should constitute an important contribution to the knowledge of poisonous plants and prove to be of value to botanists, agriculturalists and chemists as well as to those in the medicinal and veterinary fields.

B. J. YOUNGMAN.

*By R. N. Chopra, R. L. Badhwar and S. Ghosh. Vol. 1 pp. 762. fig. 164. Scientific Monograph No. 17, The Indian Council of Agricultural Research. Published by the Manager of Publications, Delhi, 1949. Price £2-6-0 (Rs. 30).

Families of Dicotyledons.*—This book consists of some 60 pages of introductory matter, much of it contributed by experts in particular branches of botany, and 158 pages given over to the description and illustration of the 240 families of dicotyledons which the author accepts. In the preface it is stated that “The family sequence at first followed the numbers of DE DALLA TORRE and HARMS (1907), the same as the Brooklyn Botanic Garden collections. Gradually various changes have seemed advisable, such as :—” Thus it is clear that the new arrangement of the families in this book is something of an after-thought and that its main purpose lies less in this, or in the introductory matter, than in making available brief descriptions and notes for each family.

It is therefore to the quality of this descriptive matter that a reviewer must pay first attention, and he will inevitably be disappointed. Work of this kind cannot avoid being, to some extent, compilatory, but when concepts of families vary as widely as do those of families of dicotyledons to-day the path of compilation is beset by many pitfalls. Dr. Gundersen includes, for instance, *Hypericaceae* and *Guttiferae* in the one family, but the statement “Lvs. . . . dotted with pellucid glands” applies to *Hypericaceae* only, the leaves of *Guttiferae* being marked by translucent resin canals but not gland-dotted. Similarly under *Ericaceae* the character “Fr. a capsule, rarely a berry or drupe” is correct if the family be accepted in a narrow sense, but here *Vacciniaceae* is included and consequently the rarity of berries in the family is utterly destroyed. Other similar instances have been noted.

Mention of such slips as these also draws attention to the fact that Dr. Gundersen does, in general, take a broad view of family limits. This does not apply to *Magnoliales*, in which he follows I. W. Bailey's concept of the families, nor in *Geraniales*, where *Oxalidaceae*, *Tropaeolaceae*, *Limnanthaceae* and *Balsaminaceae* are all maintained as distinct families. However Dr. Gundersen's total of 240 families is significantly lower than the figures 264, 261, 259 which he gives for Hutchinson, Wettstein and Diels respectively. Whatever the scientific justification of the larger family there is no doubt that it increases the difficulty of giving concise descriptions. The author's solution to this problem means that the student receives a very meagre ration of descriptive information (see *Leguminosae*, p. 111; *Chrysobalanaceae*, p. 109). After such rigorous economy of words the vacant spaces (for example on pp. 139, 145, 181) appear as a luxury the author could ill afford.

Dr. Gundersen has considerably increased the value of his volume by including under each family brief annotated references to the more important literature on its morphology and affinities. For this reason alone the book will certainly be consulted by many who would regard the family descriptions as quite inadequate. The other interesting feature is the illustrations by Miss M. H. Purdy. It is refreshing indeed to find in a book of this type that the figures are almost entirely original, and mostly drawn from the living plant. Many of them show the early stages of development of the flower, though one must comment that Dr.

*Families of Dicotyledons. By Alfred Gundersen, with introductory chapters by Chester A. Arnold, Oswald Tippo, Theodor Just, Herbert F. Copeland, J. Herbert Taylor and W. H. Camp. Drawings by Maud H. Purdy. Chronica Botanica Company, Waltham, Mass., U.S.A. \$4.50.

Gundersen's remark in his preface, that these are "suggestive of phylogenetic trends" requires substantiating.

A short review is no place to discuss the system of classification which the author has finally adopted. In the linear sequence the position of *Dianthiflorae* between *Geranium* group and *Jasminiflorae* is difficult to understand, as the schematic arrangement (p. 55) indicates that these two groups should be adjacent and the *Dianthiflorae* widely separated. As to the position of the individual families, one point which is surprising is the wide separation of *Campanulaceae* and *Compositae*, families placed in juxtaposition in most other systems. In this, as in the arrangement as a whole, Dr. Gundersen may have very sound reason for his actions, but he does not give them and in their absence no critical appreciation of his system is possible.

B. L. BURTT.

Variation and Evolution in Plants.*—Taxonomists welcome the fact that many cytogeneticists and ecologists are now linking their special researches more and more to the wider problems of evolution. With the broadening outlook of taxonomists, on the other hand, the beginnings of a much closer cooperation between taxonomists, cytogeneticists, and ecologists has commenced. One must, therefore, expect the publication of papers and books which, in different ways and to different degrees, synthesize these subjects. The book* here under consideration is of this synthetic kind with a bias towards genetics. It should be read by every botanist, and particularly by every taxonomist, for it shows, sometimes either unintentionally or at least not as the main immediate object, how very frequently light is thrown on taxonomic problems by researches on variation and evolution by genetical methods. Such methods have widened and are widening very considerably and now include not only experimentally controlled crossing and cytological analysis but also the detailed biometrical examination of wild populations, or fair samples of such. When the problems investigated include the composition and origin of taxa and their range and distribution, the realms of both taxonomy and ecology are invaded and the results have often to be incorporated in the new systematics advancing to the ideal of an omega taxonomy.

An enormous and fascinating field is surveyed by Prof. Stebbins. What he has to say is based partly on his own investigations and partly on a very wide reading of relevant, and especially modern, literature. Moreover, his style is clear, concise, and unambiguous. The writer of this note agrees with a very large majority of the conclusions reached by the author and even when, very rarely, he disagrees, it is easy to trace the basis and cause of the difference of opinion.

In support of the contention that this book should be widely read and considered the main subjects dealt with may be outlined. Variations are considered as "patterns" within the different taxa. It is concluded that "we cannot apply uncritically the criteria of species which have

*G. Ledyard Stebbins Junior: *Variation and Evolution in Plants*. Geoffrey Cumberlege, Oxford University Press, 1950. 50/-.

been developed in one group to the situations existing in another, particularly if the groups are distantly related to each other and have very different modes of life". Mutation, natural selection, and genetic systems are given special chapters and their connections with variation and evolution are clearly indicated. Isolation is considered in relation to the origin of species. It is stated definitely that "The differences between closely related species are nearly all duplicated by or paralleled by differences between races or subspecies of a single species". Moreover, the term "isolation" is accepted with a sufficiently wide connotation to include various mechanisms. The subject of hybridization naturally follows its converse of isolation and it is very useful to have a summary of some of the important work on this subject carried out in recent years particularly in North America. Polyploidy is dealt with in two chapters and apomixis and its significance as a reproductive mechanism occupy another chapter. The structural hybridity of *Oenothera* and other taxa is shown to result in loss of much flexibility. The two chapters on evolutionary trends of the karyotype and external morphology are full of important discussions. It is concluded that "all long-continued evolutionary trends in plants, as well as in animals, are guided by natural selection". This holds for all taxonomic grades. Guppy's interesting suggestions on the order of appearance of taxa does not seem to have received the consideration it deserves. The final chapter deals with fossils, modern distribution patterns, and rate of evolution.

W. B. TURRILL.

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